* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]It has two or more base stations (321, 322,323,324,325) combined with a network controller (110), it is the method of registering a mobile station (307) in a radiotelephone system (300) set up perform radio with a mobile station -- : -- stage; which registers said mobile station into the 1st base station -- in said mobile station -- : -- stage; which memorizes the 1st base station identifier -- with the 1st signal from said 1st base station. stage; which receives the 2nd signal from the 2nd base station -- stage (404); which detects the input-signal characteristic of said 1st signal and said 2nd signal -- **** being impossible for the input-signal characteristic of said 1st signal, and, When **** is possible for the input-signal characteristic of said 2nd signal, from said 2nd base station, A stage (406) of receiving a control signal containing the 2nd base station identifier and a cell grouping level; when said mobile station is registered into said 2nd base station, A stage (410) of judging said 1st base station identifier and said 2nd base station identifier from said cell grouping level; when said mobile station is not registered into said 2nd base station, In stage (414); which registers said 2nd base station, and said network controller, registration to said 2nd base station of the :aforementioned mobile station is answered, How to register a base station in a radiotelephone system being constituted by stage; which registers said mobile station into a group of a base station defined by said cell grouping level and said 2nd base station identifier.
[Claim 2]Said cell grouping level and said 1st base station identifier define the last registration group of a base station which said mobile station registered at the end, How to register a base station in the radiotelephone system according to claim 1 with which said judgment stage includes a stage (412) of judging whether said 2nd base station being included in said last registration group.
[Claim 3]Said two or more base stations are arranged on one or more axes (502,504,506), Said 1st base station identifier and said 2nd base station identifier determine a position of said 1st base station and said 2nd base station on each axis of one or more axes, respectively, A stage [difference / of a position of said 1st base station on each axis, and a position of said 2nd base station / said cell grouping level / stage / said / judgment], How to register a base station in the radiotelephone system according to claim 1 constituted by stage (412) which will be concluded if said mobile station is not registered into said 2nd base station when said difference exceeds said cell grouping level.
[Claim 4]A method characterized by comprising the following of registering a base station in the radiotelephone system according to claim 3.
Said 1st base station identifier and said 2nd base station identifier include the one or more fields, respectively, Each of the one or more aforementioned fields corresponds to one axis among said one or more axes, A stage which a position of said 1st base station and said 2nd base station is uniquely determined on each axis of the one or more axes, respectively, and said comparison step subtracts each field of said 1st mobile station identifier from each field of said 2nd base station identifier, and generates each one or more results.
A stage which will be concluded if said mobile station is not registered into said 2nd base station when it is constituted by stage [said cell grouping level / result / each] and one or more

results exceed said cell grouping level among said each result in said stage to conclude.

[Claim 5]said detection stage -- the [of said 1st signal] -- with a stage which measures received signal strength-ed [1]. the [of said 2nd signal] -- including a stage which measures received signal strength-ed [2] -- said method -- the [said] -- the [received signal strength-ed / 1 / and / said] -- a method of registering a base station in the radiotelephone system according to claim 1 which includes further a stage (406) of answering received signal strength-ed [2] and determining a nearby base station.
[Claim 6]How to register a base station in the radiotelephone system according to claim 1 with which a stage of registering said mobile station into said 2nd base station is constituted by a stage of establishing radio with said 2nd base station, and stage (414) which transmits a registry request from said mobile station to said 2nd base station.
[Claim 7]Said two or more base stations are arranged on one or more axes, and said 1st base station identifier and said 2nd base station identifier include the one or more fields, respectively, Each field of said one or more fields corresponds to one axis among said one or more axes, A position of said 1st base station and said 2nd base station is uniquely determined on each axis among said one or more axes, respectively, Said method. : In said mobile station, each field of the 1st base station identifier of :above, A stage [said cell grouping level / result / which decreases from each field of said 2nd base station identifier, and generates one or more results / stage; each]; when one of results exceeds said cell grouping level among said one or more results, A stage (412) which will be concluded if said mobile station is not registered into said 2nd base station; In said 2nd base station. : How to register a base station in the radiotelephone system according to claim 6 further constituted by stage (414); which registers into said 2nd base station stage; which receives said registry request, and said mobile station.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]Generally this invention relates to a radiotelephone system. In more detail, this invention is cordless or relates to the location registration of the mobile station in a cellular radiotelephone system.
[0002]
[Description of the Prior Art]Two or more base stations generally set up communicate with one or more mobile stations are included in a radiotelephone system. Each base station transmits and receives a radio telephony signal in each service area. The mobile station in a specific service area communicates with the base station coordinated with the area. A base station communicates between a mobile station and a public telephone switching network. A radiotelephone system is controlled by a network controller.
[0003]A mobile station moves in the inside of two or more service areas. A user may also carry with a stock that a mobile station is carried in a car. A mobile station supervises, the situation (RSS: received signal strength), for example, the received signal strength etc., of a communications channel between a mobile station and a surrounding base station, etc. If a mobile station moves to the 2nd service area from the 1st service area, communication with the base station which provides service for the 2nd service area will be established, and communication with the base station which provides service for the 1st service area will be stopped. This process is called a hand-off and, usually it performs automatically.
[0004]In order to allot a call efficiently to a specific mobile station, usually each mobile station registers the position into the nearest base station. Thereby, an incoming call is sent to the base station by a network controller, and the base station establishes radio with a mobile station, and completes a call. If a mobile station is not registered, it will warn to send the broadcast message usually called a page and to register the position into a mobile station of a radiotelephone system. If a mobile station moves to a new service area, it will register with the base station coordinated with a new service area automatically. This registration process is independently performed with a hand-off.
[0005]The number of radio channels which can be used for the purpose of the traffic of a call, paging, registration, and others is restricted for every base station. In a densely-populated area, there may be no usable radio channel in the time zone when the degree of system usage is high. As one of the solution for establishing an additional channel, the method of providing more base stations of providing service is in a smaller service area. When the urban area etc. which have many mobile stations located densely are going too far, in order to provide a number sufficient in order to communicate and to control channel traffic of channels, a service area may become small by nearly the first floor of 1 block or a skyscraper. Such a service area is called microcell.
[0006]The limit of the microcell method for providing additional communication and control channel is channel traffic needed for registration of many mobile stations which move between service areas. The number of user registration also increases inevitably as the base station in a system and the number of cells increase. Each mobile station carried all over a town must be registered into the base station which provides service for the service area into which it goes

newly, respectively.
[0007]The cause of another registration traffic is signal cover. If a signal is selectively prevented with the object within the course between a mobile station and a base station, cover will take place. By cover, it may be extreme in the input-signal quality containing received signal strength, and an abrupt change may happen to it. For example, when a mobile station is near the boundary between cells, it may change frequently between time short for signal cover of the determination of the suitable base station which a mobile station registers. Received signal strength tends to register a mobile station into the greatest base station. A user looks back upon a RSS level, and when the antenna of a mobile station is interrupted from an input signal, it may change. In such a case, a mobile station repeats registration and re-registration to two or more adjoining base stations, and makes registration traffic increase.
[0008]One of the solution proposed about the location registration in the micro cell system treating many members is a multilayer position updating method. The coverage area of the system using this method has two or more location registration area layers. It is arranged alternately and there are a fixed number of layers which lap mutually. A mobile station is divided into a group and one or more layers are assigned to each group. Each group's mobile station has some location registration area layers. If a mobile station updates the registration, a mobile station will switch a layer, namely, will update it to a different layer.
[0009]However, this method has dramatically complicated realization and is inefficient-like. In the system using the hexagon-head cellular structure from which a cell is divided into the group of 19 cells, 19 layers are required to perform this method. When the number of layers increases, in order to operate smoothly, remarkable adjustment and a system overhead are needed. Since each base station in each cell must transmit layer information so that it can decide when a mobile station should re-register, a remarkable multiple address overhead is needed. In order to divide location registration area into more layers and to have to send the same information for every cell for every layer, more broadcast information is needed.
[0010]Therefore, in especially a microcellular use, the registration method with which the mobile station in a radiotelephone system which reduces the registration traffic of a radio channel has been improved is required.
[0011]
[Example]Drawing 1 generally shows the ideal geographical layout of the radiotelephone system 100 which can use this invention. The radiotelephone system 100 is provided with two or more base stations 102 which generally include the base station 104, the base station 106, and the base station 108, and the network controller 110. The network controller 110 is combined with the public telephone switching network 112. The network controller 110 is in further two or more each base station and wire communication states of the base station 102. Each connection between the network controller 110 and two or more base stations 102 is not illustrated by drawing 1 for not complicating a drawing too much.
[0012]Each of two or more base stations 102 is set up perform one or more a mobile station and radio, such as the mobile station 116. This radio is performed according to a well-known standardization protocol with this art. The mobile radio telephone carried in the portable radiotelephone hand set in which a user can carry [the "mobile station" used here or] the word "movement" by the car, other vehicles, and built-in is pointed out. The mobile station 116 completes a call with other members combined with other mobile stations (not shown) or public telephone switching networks 112 in the system 100 through radio with the one or more base stations 104,106,108.
[0013]In order to perform effective wireless telephone communication, each base station of two or more base stations 102 provides service for each service area. thereby -- the base station 104 -- in the base station 108, the base station 106 provides service for the service area 122 in the service area 120 at the service area 118. A service area is illustrated by the hexagon in drawing 1. However, that it may have the figures in which others are [being a triangle, being a quadrangle, and] arbitrary can recognize the service area 118,120,122 in a person skilled in the art. A person skilled in the art can recognize that the system 100 can be provided with arbitrary numbers of base stations, and arbitrary numbers, such as the mobile station 116, of mobile

stations which operate in relation to the system 100.
[0014]Next, with reference to drawing 2, the cell registration as a function of the user position specification in the radiotelephone system 200 by conventional technology is shown here. In order to simplify, drawing 2 shows movement of the user in alignment with the one axis 206. . Therefore, drawing 2 carries a mobile station to the whole passing through a series of service areas in accordance with a straight course. For example, it moves along a street, a highway, or other roads, or the cell registration in the case of the user who took the train and is on the elevator in a skyscraper under travel is modeled.
[0015]The radiotelephone system 200 by conventional technology is provided with the cells 201 and 202,230,204,205 as shown in drawing 2. The cells 201 and 202,203,204,205 are linearly arranged in accordance with the axis 206. Each of the cells 201 and 202,203,204,205 is provided with one or more mobile stations located in each cell 201 and 202,203,204,205, and the base station which performs radio. The cell 201 is provided with the base station 221. The cell 202 is provided with the base station 222. The cell 203 is provided with the base station 223. The cell 204 is provided with the base station 224. The cell 205 is provided with the base station 225.
[0016]Drawing 2 shows the position to which cell registration is carried out, when the user who carries a mobile station moves in accordance with the axis 206 further. This is shown in the lower half of drawing 2, and the number in a parenthesis expresses the cell into which the mobile station 207 is registered as the mobile station 207 moves in accordance with the axis 206. This registers a mobile station into the cell 201 from the left-hand side of drawing 2. That is, the mobile station 207 is registered into the base station 221 which provides service for the service area defined by the cell 201. If a mobile station moves in accordance with the axis 206, the mobile station 207 will supervise the quality of the signal received from the base station including the base station 222 located in the base station 221 located in the cell 201, and the cell 202. If the signal quality of the signal received from the base station 222, received signal strength (RSS), etc. exceed the quality of the signal received from the base station 221 in the designated point 208 on the axis 206, a hand set will be registered into the base station 222 in the cell 202, and will suspend registration with the base station 221 in the cell 201. By the quality of various input signals, and the hysteresis of the signal strength equalization algorithm which the mobile station 207 uses. It may reach, after a hand set crosses the point 210, i.e., the point of specifying the geographical boundary line of the cell 201 and the cell 202 at the point 208, that registration with the cell 202 is performed. The mobile station 207 continues movement in accordance with the axis 206, and continues the surveillance of input-signal quality. A mobile station will be registered into the base station 223 in the cell 203 if a mobile station reaches the point 212.
[0017]When the user who carries the mobile station 207 goes into the service area of the radiotelephone system 200 by this, the mobile station 207, It registers with the cell 201 first and the network controller (not shown) of the system 200 enables it to send the call of the mobile station 207 to the cell 201. If the mobile station 207 moves to the cell 202, the 2nd registration will be performed automatically and a network controller will be updated to the service area containing newly. The mobile station 207 starts a registration process based on the signal strength and quality which were received from each cell. In order to avoid the multiple registration between the cells by change of the signal in the halfway point and the point 210, the mobile station 207 performs an equalization algorithm with a hysteresis. Thereby, the registration to an adjacent cell is usually delayed until the mobile station 207 fully enters in an adjacent cell at the point 208. Even if it uses an equalization algorithm, the multiple registration in the halfway point between cells still happens according to the shielding effect of object cover or other small sectors. Network traffic increases for such multiple registration, usable capacity decreases, and the battery shelf life of the mobile station 207 becomes short.
[0018]Next, with reference to drawing 3, the cell registration as a function of the user position specification in the wireless telephone communications system 300 by this invention is shown here. The system 300 is divided into two or more cell or service areas 301 and 302,303,304,305. Drawing 3 shows the one-dimensional system 300 which the user who carries the mobile station 307 moves in accordance with the one axis 306 like drawing 2. Thereby, drawing 3 models cell registration in case a user carries a mobile station in accordance with a straight course to the

whole, such as inside of a road, a railroad, or an elevator.
[0019]The system 300 equips each service area 301 and 302,303,304,305 of two or more service areas with two or more base stations where each provides service. The service area 301 is provided with the base station 321. The service area 302 is provided with the base station 322. The service area 303 is provided with the base station 323. The service area 304 is provided with the base station 324. The service area 305 is provided with the base station 325. The base station which provides service for each service areas 301 and 302,303,304,305 establishes a mobile station and radio, such as the mobile station 307 located in each service area 301 and 302,303,304,305. A base station transmits system information on a control channel, and this is received by mobile stations, such as the mobile station 307. A base station and a mobile station communicate using a control channel and a communications channel according to a predetermined communications protocol.
[0020]Drawing 3 shows further the position which cell registration generates, when the user who carries a mobile station moves in accordance with the axis 306. Cell grouping level 1 is assumed in drawing 3. This is shown in the lower half of drawing 3, and the number in a parenthesis shows the cell or service area where the mobile station 307 is registered, when a mobile station moves in accordance with the axis 306. This registers the mobile station 307 into the cell 301 from the left-hand side of drawing 3. That is, the mobile station 307 is registered into the base station 321 which provides service for the service area defined by the cell 301. The mobile station 307 is registered also into all the cells in the group of the cell defined by cell grouping level 1 by this invention. Now, a mobile station is registered also into the cell 302 as shown in drawing 3.
[0021]If the mobile station 307 moves in accordance with the axis 306, the mobile station 307 will supervise the quality of the signal received from the base station including the base station 323 located in the base station 321 located in the cell 301, the base station 322 located in the cell 302, and the cell 303. If the quality of the signal received from the base station 321 and the base station 322 is exceeded, the quality (RSS:received signal strength), for example, the received signal strength etc., of the signal received from the base station 323, etc., The mobile station 307 is registered into the base station 323 in the cell 303 in the point 308. By the quality of various input signals, and the hysteresis of the signal strength equalization algorithm which the mobile station 307 uses, the point 308 that registration with the cell 202 is performed may be reached, after the mobile station 307 crosses the point of defining the geographical boundary line between the cell 302 and the cell 303.
[0022]If the mobile station 307 registers with the base station 323, a mobile station will be registered also into all the base stations in the group of the cell defined by cell grouping level 1 by this invention. That is, a mobile station is registered also into the base station 324 in the cell 304, and the base station 322 in the cell 302. At this point, a mobile station is freely movable without the necessity for re-registration in any [of the cell 302,303 or 304]. For example, movement of the mobile station 307 within the cell 303 near the boundary of the cell 303 and the cell 304 is closely performed on the boundary of the cell 303 and the cell 302, without repeating two the adjoining registration with a base station and re-registration. Thereby, the registration traffic in the radiotelephone system 300 is reduced.
[0023]The mobile station 307 continues movement in accordance with the axis 306, and continues the surveillance of input-signal quality. If the signal quality from the base station 325 in the cell 305 exceeds the signal quality from the base station 324 in the cell 304, the mobile station 307 will be registered into the base station 325 in the cell 305. By this invention and cell grouping level 1, the mobile station 307 is registered also into the base station 324 in the cell 304, or maintains the registration.
[0024]Drawing 3 shows the cell grouping of level 1, and this indicates the number of the cells which adjoin the registration cell contained in registration area to be a threshold. The mobile station 307 is registered into all the cells which follow a registration cell in the cell grouping of level 1. However, the level of the cell grouping provided by an algorithm may change. For example, the cell grouping of the level 2 or the level 3 is also possible. Preferably, for every cell, it is programmable and this level is downloaded to the mobile station 307 between registration processes. Thereby, according to the system demand over the traffic and the system 300 which

are changing, a cell grouping can be adjusted dynamically.
[0025]Drawing 4 is a flow chart showing how to register the mobile station in the radiotelephone system by this invention. This method starts at Step 402 and mobile stations, such as the mobile station 307 (drawing 3), go into the coverage area of radiotelephone systems, such as the radiotelephone system 300 (drawing 3), here. At Step 404, a mobile station receives the 1st signal from the 1st base station that provides service for the 1st service area. A mobile station also receives the 2nd signal from the 2nd base station, and receives other signals similarly. Preferably, the 1st signal and the 2nd signal are constituted by the control channel signal by which the multiple address is carried out in the 1st and 2nd base stations. A control channel signal includes system information, such as a base station identifier which identifies uniquely the 1st base station and the 2nd base station in a radiotelephone system. By this invention, system information also contains the cell grouping level which defines the group of one or more service areas including the 1st service area. A cell grouping level defines so that it may be explained in detail below, the hierarchy of a service area, i.e., number of cells, surrounding the 1st service area where a mobile station is automatically registered by a radiotelephone system.
[0026]A mobile station detects the input-signal characteristic of the 1st signal, the 2nd signal, and other input signals at Step 404. Preferably, a signal characteristic is concerned with the quality of input signals, such as a received-signal-strength index (RSSI:received signal strength indication). The circuit which detects a received-signal-strength index is a well-known thing with this art. Answering the input-signal characteristic, a mobile station chooses the base station which receives the signal with which a mobile station has the best signal quality as the 1st base station. For example, a mobile station judges which base station has the maximum received signal strength corresponding to a nearby base station.
[0027]At Step 406, a mobile station receives the 1st signal by which the multiple address was carried out in the 1st base station. A mobile station determines system information from the 1st signal. A cell grouping level, and the 1st cell identifier or base station identifier which identifies a base station uniquely is preferably contained in system information.
[0028]Preferably, the service area in radiotelephone systems, such as a service area, is arranged in accordance with one or more axes. In a multidimensional system, a service area is arranged in accordance with two or more axes. By this invention, a base station identifier (or cell identifier) decides on the place of a base station (related service area) uniquely on each axis of one or more axes. The one or more fields corresponding to one axis are preferably included in a base station identifier among one or more axes. It can consider that a cell or a service area is in the hierarchy of the service area surrounding a specific service area using a base station identifier.
[0029]Although explanation of this method is continued, a mobile station judges whether the mobile station is registered into one cell of the present radiotelephone systems at Step 408. Preferably, a mobile station is provided with the memory which memorizes the index of the precedence cell registration containing the last registration cell identifier which shows the base station identifier of the final cell which the mobile station had registered when there is it. A mobile station is not registered yet at the time of about [by which about / the mobile station went into the coverage area of the system / was started in / about / it], but execution follows Step 414. When a mobile station may be registered before, the registration information containing the last registration cell identifier is read by a mobile station, and execution follows Step 410.
[0030]At Step 410, it is judged whether the base station identifier of a mobile station of the 1st (nearby) base station corresponds with the last registration cell identifier. If these two identifiers are in agreement, a mobile station may be before registered into a nearby base station, and execution will follow Step 416. When two identifiers are not in agreement, it must determine whether a mobile station needs the registration to a nearby base station, and a method follows Step 412.
[0031]It is judged whether a mobile station is contained in the group of one or more service areas defined by the cell grouping level surrounding the service area where the last registration of the nearby base station judged at Step 404 was carried out at Step 412. Preferably, a mobile station relates to the nearby base station identifier and the last registration cell identifier of a base station as follows.

[0032]A mobile station compares the nearby base station identifier and the last registration base station identifier of a base station. Among each axial field of the base station identifier of a nearby base station, when the absolute value of the difference of arbitrary one and the last registration base station is larger than a cell grouping level, a mobile station is registered into a nearby base station. The fundamental algorithm which judges whether a mobile station is in the present registration cell group and whether this calculation is out of it is expressed.
[0033]As for a method, a mobile station is registered there following Step 414. In order to register, a mobile station establishes a nearby base station and radio according to the wireless application protocol of a radiotelephone system. Next, a mobile station transmits a registry request to a nearby base station, and a base station registers a mobile station into the base station, and sends registration information to a network controller.
[0034]A mobile station is registered into the 1st base station and all the base stations in the group defined by a cell grouping level under control of a network controller. Thereby, in the cell grouping level of 1, a mobile station is registered into the hierarchy of a service area including the service area coordinated with the 1st base station, and all the service areas which adjoin directly. When a cell grouping level is 2, a mobile station is further registered into all the service areas which adjoin the group of the grouping level 1 of a cell directly. The buffer for one cell is made into the circumference of the cell (service area) which receives offer of service by the present nearby base station by this method of using cell grouping level 1. Thereby, the multiple registration by change of a signal or cover between cells is lost. Since a mobile station will be registered also into an adjoining service area if a mobile station is further registered into a service area as for this method, the cell registration in a system is reduced.
[0035]Registration to an adjacent cell is preferably performed by the network controller (not shown), and the system can eliminate registration traffic further. A network controller determines which service area registers a mobile station using the same algorithm as a mobile station. The network controller of a system allots a call to a mobile station based on the knowledge of the dynamic registration algorithm of a mobile station.
[0036]With reference to drawing 5, the cell discrimination system for the two-dimensional hexagon-head cell pattern used with this invention is illustrated. Drawing 5 illustrates assignment in the cell in the hexagon-head cell pattern 500 of the location parameter called a cell identifier. Each of a cell is arranged in accordance with three axes including the 1st axis 502, the 2nd axis 504, and the 3rd axis 506.Each field is coordinated with one axis and the number in the field specifies the cell position on an axis. The adjacent cell which has the same axial field number has a fixed position in accordance with an individual axis, and forms a straight line vertical to the axis illustrated with the straight line 508 and the axis 502. Same location parameter assignment using a multiplex shaft can be performed about the cell pattern using cells of a different form, such as a triangular cell or a square cell. It is extensible to a three-dimensional cell pattern by using the 4th axis prolonged in the same location parameter quota method from the page containing drawing 5. Such a cell pattern may exist in the microcellular radiotelephone system installed in the office building of a layered story.
[0037]Drawing 6 shows the cell grouping of a level which differs in a hexagon-head cell pattern, and the identifier 500 used for this invention. The single big digit in each cell expresses axial offset of the maximum of the cell which has the identifier 555, and three small numbers express each axial offset. By the group level calculation in [whole] an above-mentioned algorithm, the mobile station registered into the cell 555 will only be registered into a new cell, if the group level with which the size of the axial field of a new cell was specified is exceeded. For this reason, registration will be performed if a number with a big mobile station moves to the cell exceeding a group level by drawing 6. If it registers with the base station which provides service for the service area which a mobile station coordinates with the cell discriminated from 555 of the center of drawing 6 about the cell grouping of level 1, The mobile station is automatically registered also into all the cells in the group 602 by a network controller (not shown). Therefore, the notice of an incoming call to a mobile station is sent to all the cells in the group 602. To all the cells with the axial offset from the last mobile station cell registration which does not exceed a group level, this only sends the notice of a call and is performed by a network. If a mobile

station registers with the cell discriminated from 555 about the cell grouping of the level 2, the mobile station will be automatically registered also into all the cells in the group 604.
[0038]In drawing 6, it turns out that each service area is surrounded by the hierarchies of a service area, and that a cell grouping level expresses the hierarchy number of the service area surrounding a specific service area. For example, since all service areas are shown by the big number 1 as shown in drawing 6, the group 602 is equivalent to the hierarchy of an identifiable service area. The 2nd hierarchy's service area includes the service area shown in the big number 2 within drawing 6.
[0039]Drawing 7 shows the location registration of the level 2 by the mobile station 702 in the radiotelephone system 700 by this invention. In the two-dimensional system 700 shown in drawing 7, even if the mobile station 702 meets any of three cell axes included at the flat surface of a page, it is freely movable. Drawing 7 shows the grouping of the level 2.
[0040]If the mobile station 702 goes into the service area of the system 700, the mobile station 702 will be registered into the cell 704 in the point 1 of drawing 7. That is, the mobile station 702 is registered into the base station (not shown) which provides service for the cell 704. The mobile station 702 is automatically registered into all the cells contained in the group 706 for registration of the level 2. In order to make it intelligible, by drawing 7, these cells put in horizontal hatching and are illustrated. Now, the mobile station 702 has a buffer for two cells around the cell registered now.
[0041]If the mobile station 702 moves in accordance with the course 708, the mobile station 702 will come to the cell 710 into which the mobile station 702 has not been registered yet so that it may be shown by the result of algorithm calculation of the level 2. Now, a mobile station is registered into the cell 710 in the point 2 of drawing 6. the registration to the cell 710 -- in addition, the mobile station 702 is automatically registered also into all the cells in the group 712, and generates the boundary for two cells around the registration cell 710 also here. The mobile station 702 can be moved anywhere in the buffer space for these two cells defined by the group 712, without re-registering.
[0042]If the mobile station 702 moves in accordance with the course 708 to the point 3 of drawing 6, a mobile station will come to the cell 714. The mobile station 702 is not registered into this cell. Therefore, at the point 3, the mobile station 702 is registered into the cell 714, and is registered into all the cells further located in the group 716. The cell in the group 716 is identified by vertical hatching. In accordance with the course 708, it moves further, and if the mobile station 702 reaches the cell 718 which has not been registered yet, a mobile station will be registered into the cell 718 and will be automatically registered into all the cells contained in the group 720.
[0043]As shown in drawing 7, once registration is performed, the big thing for which registration is again started for signal cover ******** again will be lost by a new cell grouping. For this reason, the influence of the automatic position registered signal intensity equalization algorithm which the mobile station 702 uses decreases. Location registration becomes random through the whole service area by the dynamic cell grouping by this invention. That is, registration relates to the motion before a user. The location registration peaks which happen by this when a cell group is fixed are reduced. Since the cell group by this invention changes dynamically, they are scattered all over the whole service area, without concentrating on the cell border where location registration was fixed.
[0044]The above shows that this invention provides the system and method of registering the mobile station in a wireless telephone communications system. A mobile station will be registered into all the cells which are in a registration group further, if a mobile station registers with a registration cell in order to reduce the location registration traffic in a system. A group may contain a registration cell and all the continuous cells at least, and may contain the cell around other layers further. The level of registration is changed dynamically and corresponds to the radio-channel traffic in a wireless telephone communications system.
[0045]Although the specific example of this invention was illustrated and described, it can correct, therefore an attached claim includes such all the change and corrections included in the pneuma and the range of this invention.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application]Generally this invention relates to a radiotelephone system. In more detail, this invention is cordless or relates to the location registration of the mobile station in a cellular radiotelephone system.

[Translation done.]

TECHNICAL PROBLEM

[Description of the Prior Art]Two or more base stations generally set up communicate with one or more mobile stations are included in a radiotelephone system. Each base station transmits and receives a radio telephony signal in each service area. The mobile station in a specific service area communicates with the base station coordinated with the area. A base station communicates between a mobile station and a public telephone switching network. A radiotelephone system is controlled by a network controller.
[0003]A mobile station moves in the inside of two or more service areas. A user may also carry with a stock that a mobile station is carried in a car. A mobile station supervises, the situation (RSS: received signal strength), for example, the received signal strength etc., of a communications channel between a mobile station and a surrounding base station, etc. If a mobile station moves to the 2nd service area from the 1st service area, communication with the base station which provides service for the 2nd service area will be established, and communication with the base station which provides service for the 1st service area will be stopped. This process is called a hand-off and, usually it performs automatically.
[0004]In order to allot a call efficiently to a specific mobile station, usually each mobile station registers the position into the nearest base station. Thereby, an incoming call is sent to the base station by a network controller, and the base station establishes radio with a mobile station, and completes a call. If a mobile station is not registered, it will warn to send the broadcast message usually called a page and to register the position into a mobile station of a radiotelephone system. If a mobile station moves to a new service area, it will register with the base station coordinated with a new service area automatically. This registration process is independently performed with a hand-off.
[0005]The number of radio channels which can be used for the purpose of the traffic of a call, paging, registration, and others is restricted for every base station. In a densely-populated area, there may be no usable radio channel in the time zone when the degree of system usage is high. As one of the solution for establishing an additional channel, the method of providing more base stations of providing service is in a smaller service area. When the urban area etc. which have many mobile stations located densely are going too far, in order to provide a number sufficient in order to communicate and to control channel traffic of channels, a service area may become small by nearly the first floor of 1 block or a skyscraper. Such a service area is called microcell.
[0006]The limit of the microcell method for providing additional communication and control channel is channel traffic needed for registration of many mobile stations which move between service areas. The number of user registration also increases inevitably as the base station in a system and the number of cells increase. Each mobile station carried all over a town must be registered into the base station which provides service for the service area into which it goes newly, respectively.
[0007]The cause of another registration traffic is signal cover. If a signal is selectively prevented with the object within the course between a mobile station and a base station, cover will take place. By cover, it may be extreme in the input-signal quality containing received signal strength, and an abrupt change may happen to it. For example, when a mobile station is near the boundary between cells, it may change frequently between time short for signal cover of the determination

of the suitable base station which a mobile station registers. Received signal strength tends to register a mobile station into the greatest base station. A user looks back upon a RSS level, and when the antenna of a mobile station is interrupted from an input signal, it may change. In such a case, a mobile station repeats registration and re-registration to two or more adjoining base stations, and makes registration traffic increase.

[0008]One of the solution proposed about the location registration in the micro cell system treating many members is a multilayer position updating method. The coverage area of the system using this method has two or more location registration area layers. It is arranged alternately and there are a fixed number of layers which lap mutually. A mobile station is divided into a group and one or more layers are assigned to each group. Each group's mobile station has some location registration area layers. If a mobile station updates the registration, a mobile station will switch a layer, namely, will update it to a different layer.

[0009]However, this method has dramatically complicated realization and is inefficient-like. In the system using the hexagon-head cellular structure from which a cell is divided into the group of 19 cells, 19 layers are required to perform this method. When the number of layers increases, in order to operate smoothly, remarkable adjustment and a system overhead are needed. Since each base station in each cell must transmit layer information so that it can decide when a mobile station should re-register, a remarkable multiple address overhead is needed. In order to divide location registration area into more layers and to have to send the same information for every cell for every layer, more broadcast information is needed.

[0010]Therefore, in especially a microcellular use, the registration method with which the mobile station in a radiotelephone system which reduces the registration traffic of a radio channel has been improved is required.

[Translation done.]

* NOTICES *

EXAMPLE

[Example]Drawing 1 generally shows the ideal geographical layout of the radiotelephone system 100 which can use this invention. The radiotelephone system 100 is provided with two or more base stations 102 which generally include the base station 104, the base station 106, and the base station 108, and the network controller 110. The network controller 110 is combined with the public telephone switching network 112. The network controller 110 is in further two or more each base station and wire communication states of the base station 102. Each connection between the network controller 110 and two or more base stations 102 is not illustrated by drawing 1 for not complicating a drawing too much.
[0012]Each of two or more base stations 102 is set up perform one or more a mobile station and radio, such as the mobile station 116. This radio is performed according to a well-known standardization protocol with this art. The mobile radio telephone carried in the portable radiotelephone hand set in which a user can carry [the "mobile station" used here or] the word "movement" by the car, other vehicles, and built-in is pointed out. The mobile station 116 completes a call with other members combined with other mobile stations (not shown) or public telephone switching networks 112 in the system 100 through radio with the one or more base stations 104,106,108.
[0013]In order to perform effective wireless telephone communication, each base station of two or more base stations 102 provides service for each service area. thereby -- the base station 104 -- in the base station 108, the base station 106 provides service for the service area 122 in the service area 120 at the service area 118. A service area is illustrated by the hexagon in drawing 1. However, that it may have the figures in which others are [being a triangle, being a quadrangle, and] arbitrary can recognize the service area 118,120,122 in a person skilled in the art. A person skilled in the art can recognize that the system 100 can be provided with arbitrary numbers of base stations, and arbitrary numbers, such as the mobile station 116, of mobile stations which operate in relation to the system 100.
[0014]Next, with reference to drawing 2, the cell registration as a function of the user position specification in the radiotelephone system 200 by conventional technology is shown here. In order to simplify, drawing 2 shows movement of the user in alignment with the one axis 206. . Therefore, drawing 2 carries a mobile station to the whole passing through a series of service areas in accordance with a straight course. For example, it moves along a street, a highway, or other roads, or the cell registration in the case of the user who took the train and is on the elevator in a skyscraper under travel is modeled.
[0015]The radiotelephone system 200 by conventional technology is provided with the cells 201 and 202,230,204,205 as shown in drawing 2. The cells 201 and 202,203,204,205 are linearly arranged in accordance with the axis 206. Each of the cells 201 and 202,203,204,205 is provided with one or more mobile stations located in each cell 201 and 202,203,204,205, and the base station which performs radio. The cell 201 is provided with the base station 221. The cell 202 is provided with the base station 222. The cell 203 is provided with the base station 223. The cell 204 is provided with the base station 224. The cell 205 is provided with the base station 225.
[0016]Drawing 2 shows the position to which cell registration is carried out, when the user who carries a mobile station moves in accordance with the axis 206 further. This is shown in the

lower half of drawing 2, and the number in a parenthesis expresses the cell into which the mobile station 207 is registered as the mobile station 207 moves in accordance with the axis 206. This registers a mobile station into the cell 201 from the left-hand side of drawing 2. That is, the mobile station 207 is registered into the base station 221 which provides service for the service area defined by the cell 201. If a mobile station moves in accordance with the axis 206, the mobile station 207 will supervise the quality of the signal received from the base station including the base station 222 located in the base station 221 located in the cell 201, and the cell 202. If the signal quality of the signal received from the base station 222, received signal strength (RSS), etc. exceed the quality of the signal received from the base station 221 in the designated point 208 on the axis 206, a hand set will be registered into the base station 222 in the cell 202, and will suspend registration with the base station 221 in the cell 201. By the quality of various input signals, and the hysteresis of the signal strength equalization algorithm which the mobile station 207 uses. It may reach, after a hand set crosses the point 210, i.e., the point of specifying the geographical boundary line of the cell 201 and the cell 202 at the point 208, that registration with the cell 202 is performed. The mobile station 207 continues movement in accordance with the axis 206, and continues the surveillance of input-signal quality. A mobile station will be registered into the base station 223 in the cell 203 if a mobile station reaches the point 212.

[0017]When the user who carries the mobile station 207 goes into the service area of the radiotelephone system 200 by this, the mobile station 207, It registers with the cell 201 first and the network controller (not shown) of the system 200 enables it to send the call of the mobile station 207 to the cell 201. If the mobile station 207 moves to the cell 202, the 2nd registration will be performed automatically and a network controller will be updated to the service area containing newly. The mobile station 207 starts a registration process based on the signal strength and quality which were received from each cell. In order to avoid the multiple registration between the cells by change of the signal in the halfway point and the point 210, the mobile station 207 performs an equalization algorithm with a hysteresis. Thereby, the registration to an adjacent cell is usually delayed until the mobile station 207 fully enters in an adjacent cell at the point 208. Even if it uses an equalization algorithm, the multiple registration in the halfway point between cells still happens according to the shielding effect of object cover or other small sectors. Network traffic increases for such multiple registration, usable capacity decreases, and the battery shelf life of the mobile station 207 becomes short.

[0018]Next, with reference to drawing 3, the cell registration as a function of the user position specification in the wireless telephone communications system 300 by this invention is shown here. The system 300 is divided into two or more cell or service areas 301 and 302,303,304,305. Drawing 3 shows the one-dimensional system 300 which the user who carries the mobile station 307 moves in accordance with the one axis 306 like drawing 2. Thereby, drawing 3 models cell registration in case a user carries a mobile station in accordance with a straight course to the whole, such as inside of a road, a railroad, or an elevator.

[0019]The system 300 equips each service area 301 and 302,303,304,305 of two or more service areas with two or more base stations where each provides service. The service area 301 is provided with the base station 321. The service area 302 is provided with the base station 322. The service area 303 is provided with the base station 323. The service area 304 is provided with the base station 324. The service area 305 is provided with the base station 325. The base station which provides service for each service areas 301 and 302,303,304,305 establishes a mobile station and radio, such as the mobile station 307 located in each service area 301 and 302,303,304,305. A base station transmits system information on a control channel, and this is received by mobile stations, such as the mobile station 307. A base station and a mobile station communicate using a control channel and a communications channel according to a predetermined communications protocol.

[0020]Drawing 3 shows further the position which cell registration generates, when the user who carries a mobile station moves in accordance with the axis 306. Cell grouping level 1 is assumed in drawing 3. This is shown in the lower half of drawing 3, and the number in a parenthesis shows the cell or service area where the mobile station 307 is registered, when a mobile station moves in accordance with the axis 306. This registers the mobile station 307 into the cell 301 from the

left-hand side of drawing 3. That is, the mobile station 307 is registered into the base station 321 which provides service for the service area defined by the cell 301. The mobile station 307 is registered also into all the cells in the group of the cell defined by cell grouping level 1 by this invention. Now, a mobile station is registered also into the cell 302 as shown in drawing 3.
[0021]If the mobile station 307 moves in accordance with the axis 306, the mobile station 307 will supervise the quality of the signal received from the base station including the base station 323 located in the base station 321 located in the cell 301, the base station 322 located in the cell 302, and the cell 303. If the quality of the signal received from the base station 321 and the base station 322 is exceeded, the quality (RSS:received signal strength), for example, the received signal strength etc., of the signal received from the base station 323, etc., The mobile station 307 is registered into the base station 323 in the cell 303 in the point 308. By the quality of various input signals, and the hysteresis of the signal strength equalization algorithm which the mobile station 307 uses, the point 308 that registration with the cell 202 is performed may be reached, after the mobile station 307 crosses the point of defining the geographical boundary line between the cell 302 and the cell 303.
[0022]If the mobile station 307 registers with the base station 323, a mobile station will be registered also into all the base stations in the group of the cell defined by cell grouping level 1 by this invention. That is, a mobile station is registered also into the base station 324 in the cell 304, and the base station 322 in the cell 302. At this point, a mobile station is freely movable without the necessity for re-registration in any [of the cell 302,303 or 304]. For example, movement of the mobile station 307 within the cell 303 near the boundary of the cell 303 and the cell 304 is closely performed on the boundary of the cell 303 and the cell 302, without repeating two the adjoining registration with a base station and re-registration. Thereby, the registration traffic in the radiotelephone system 300 is reduced.
[0023]The mobile station 307 continues movement in accordance with the axis 306, and continues the surveillance of input-signal quality. If the signal quality from the base station 325 in the cell 305 exceeds the signal quality from the base station 324 in the cell 304, the mobile station 307 will be registered into the base station 325 in the cell 305. By this invention and cell grouping level 1, the mobile station 307 is registered also into the base station 324 in the cell 304, or maintains the registration.
[0024]Drawing 3 shows the cell grouping of level 1, and this indicates the number of the cells which adjoin the registration cell contained in registration area to be a threshold. The mobile station 307 is registered into all the cells which follow a registration cell in the cell grouping of level 1. However, the level of the cell grouping provided by an algorithm may change. For example, the cell grouping of the level 2 or the level 3 is also possible. Preferably, for every cell, it is programmable and this level is downloaded to the mobile station 307 between registration processes. Thereby, according to the system demand over the traffic and the system 300 which are changing, a cell grouping can be adjusted dynamically.
[0025]Drawing 4 is a flow chart showing how to register the mobile station in the radiotelephone system by this invention. This method starts at Step 402 and mobile stations, such as the mobile station 307 (drawing 3), go into the coverage area of radiotelephone systems, such as the radiotelephone system 300 (drawing 3), here. At Step 404, a mobile station receives the 1st signal from the 1st base station that provides service for the 1st service area. A mobile station also receives the 2nd signal from the 2nd base station, and receives other signals similarly. Preferably, the 1st signal and the 2nd signal are constituted by the control channel signal by which the multiple address is carried out in the 1st and 2nd base stations. A control channel signal includes system information, such as a base station identifier which identifies uniquely the 1st base station and the 2nd base station in a radiotelephone system. By this invention, system information also contains the cell grouping level which defines the group of one or more service areas including the 1st service area. A cell grouping level defines so that it may be explained in detail below, the hierarchy of a service area, i.e., number of cells, surrounding the 1st service area where a mobile station is automatically registered by a radiotelephone system.
[0026]A mobile station detects the input-signal characteristic of the 1st signal, the 2nd signal, and other input signals at Step 404. Preferably, a signal characteristic is concerned with the

quality of input signals, such as a received-signal-strength index (RSSI:received signal strength indication). The circuit which detects a received-signal-strength index is a well-known thing with this art. Answering the input-signal characteristic, a mobile station chooses the base station which receives the signal with which a mobile station has the best signal quality as the 1st base station. For example, a mobile station judges which base station has the maximum received signal strength corresponding to a nearby base station.
[0027]At Step 406, a mobile station receives the 1st signal by which the multiple address was carried out in the 1st base station. A mobile station determines system information from the 1st signal. A cell grouping level, and the 1st cell identifier or base station identifier which identifies a base station uniquely is preferably contained in system information.
[0028]Preferably, the service area in radiotelephone systems, such as a service area, is arranged in accordance with one or more axes. In a multidimensional system, a service area is arranged in accordance with two or more axes. By this invention, a base station identifier (or cell identifier) decides on the place of a base station (related service area) uniquely on each axis of one or more axes. The one or more fields corresponding to one axis are preferably included in a base station identifier among one or more axes. It can consider that a cell or a service area is in the hierarchy of the service area surrounding a specific service area using a base station identifier.
[0029]Although explanation of this method is continued, a mobile station judges whether the mobile station is registered into one cell of the present radiotelephone systems at Step 408. Preferably, a mobile station is provided with the memory which memorizes the index of the precedence cell registration containing the last registration cell identifier which shows the base station identifier of the final cell which the mobile station had registered when there is it. A mobile station is not registered yet at the time of about [by which about / the mobile station went into the coverage area of the system / was started in / about / it], but execution follows Step 414. When a mobile station may be registered before, the registration information containing the last registration cell identifier is read by a mobile station, and execution follows Step 410.
[0030]At Step 410, it is judged whether the base station identifier of a mobile station of the 1st (nearby) base station corresponds with the last registration cell identifier. If these two identifiers are in agreement, a mobile station may be before registered into a nearby base station, and execution will follow Step 416. When two identifiers are not in agreement, it must determine whether a mobile station needs the registration to a nearby base station, and a method follows Step 412.
[0031]It is judged whether a mobile station is contained in the group of one or more service areas defined by the cell grouping level surrounding the service area where the last registration of the nearby base station judged at Step 404 was carried out at Step 412. Preferably, a mobile station relates to the nearby base station identifier and the last registration cell identifier of a base station as follows.
[0032]A mobile station compares the nearby base station identifier and the last registration base station identifier of a base station. Among each axial field of the base station identifier of a nearby base station, when the absolute value of the difference of arbitrary one and the last registration base station is larger than a cell grouping level, a mobile station is registered into a nearby base station. The fundamental algorithm which judges whether a mobile station is in the present registration cell group and whether this calculation is out of it is expressed.
[0033]As for a method, a mobile station is registered there following Step 414. In order to register, a mobile station establishes a nearby base station and radio according to the wireless application protocol of a radiotelephone system. Next, a mobile station transmits a registry request to a nearby base station, and a base station registers a mobile station into the base station, and sends registration information to a network controller.
[0034]A mobile station is registered into the 1st base station and all the base stations in the group defined by a cell grouping level under control of a network controller. Thereby, in the cell grouping level of 1, a mobile station is registered into the hierarchy of a service area including the service area coordinated with the 1st base station, and all the service areas which adjoin directly. When a cell grouping level is 2, a mobile station is further registered into all the service areas which adjoin the group of the grouping level 1 of a cell directly. The buffer for one cell is

made into the circumference of the cell (service area) which receives offer of service by the present nearby base station by this method of using cell grouping level 1. Thereby, the multiple registration by change of a signal or cover between cells is lost. Since a mobile station will be registered also into an adjoining service area if a mobile station is further registered into a service area as for this method, the cell registration in a system is reduced.
[0035]Registration to an adjacent cell is preferably performed by the network controller (not shown), and the system can eliminate registration traffic further. A network controller determines which service area registers a mobile station using the same algorithm as a mobile station. The network controller of a system allots a call to a mobile station based on the knowledge of the dynamic registration algorithm of a mobile station.
[0036]With reference to drawing 5, the cell discrimination system for the two-dimensional hexagon-head cell pattern used with this invention is illustrated. Drawing 5 illustrates assignment in the cell in the hexagon-head cell pattern 500 of the location parameter called a cell identifier. Each of a cell is arranged in accordance with three axes including the 1st axis 502, the 2nd axis 504, and the 3rd axis 506.Each field is coordinated with one axis and the number in the field specifies the cell position on an axis. The adjacent cell which has the same axial field number has a fixed position in accordance with an individual axis, and forms a straight line vertical to the axis illustrated with the straight line 508 and the axis 502. Same location parameter assignment using a multiplex shaft can be performed about the cell pattern using cells of a different form, such as a triangular cell or a square cell. It is extensible to a three-dimensional cell pattern by using the 4th axis prolonged in the same location parameter quota method from the page containing drawing 5. Such a cell pattern may exist in the microcellular radiotelephone system installed in the office building of a layered story.
[0037]Drawing 6 shows the cell grouping of a level which differs in a hexagon-head cell pattern, and the identifier 500 used for this invention. The single big digit in each cell expresses axial offset of the maximum of the cell which has the identifier 555, and three small numbers express each axial offset. By the group level calculation in [whole] an above-mentioned algorithm, the mobile station registered into the cell 555 will only be registered into a new cell, if the group level with which the size of the axial field of a new cell was specified is exceeded. For this reason, registration will be performed if a number with a big mobile station moves to the cell exceeding a group level by drawing 6. If it registers with the base station which provides service for the service area which a mobile station coordinates with the cell discriminated from 555 of the center of drawing 6 about the cell grouping of level 1, The mobile station is automatically registered also into all the cells in the group 602 by a network controller (not shown). Therefore, the notice of an incoming call to a mobile station is sent to all the cells in the group 602. To all the cells with the axial offset from the last mobile station cell registration which does not exceed a group level, this only sends the notice of a call and is performed by a network. If a mobile station registers with the cell discriminated from 555 about the cell grouping of the level 2, the mobile station will be automatically registered also into all the cells in the group 604.
[0038]In drawing 6, it turns out that each service area is surrounded by the hierarchies of a service area, and that a cell grouping level expresses the hierarchy number of the service area surrounding a specific service area. For example, since all service areas are shown by the big number 1 as shown in drawing 6, the group 602 is equivalent to the hierarchy of an identifiable service area. The 2nd hierarchy's service area includes the service area shown in the big number 2 within drawing 6.
[0039]Drawing 7 shows the location registration of the level 2 by the mobile station 702 in the radiotelephone system 700 by this invention. In the two-dimensional system 700 shown in drawing 7, even if the mobile station 702 meets any of three cell axes included at the flat surface of a page, it is freely movable. Drawing 7 shows the grouping of the level 2.
[0040]If the mobile station 702 goes into the service area of the system 700, the mobile station 702 will be registered into the cell 704 in the point 1 of drawing 7. That is, the mobile station 702 is registered into the base station (not shown) which provides service for the cell 704. The mobile station 702 is automatically registered into all the cells contained in the group 706 for registration of the level 2. In order to make it intelligible, by drawing 7, these cells put in

horizontal hatching and are illustrated. Now, the mobile station 702 has a buffer for two cells around the cell registered now.
[0041]If the mobile station 702 moves in accordance with the course 708, the mobile station 702 will come to the cell 710 into which the mobile station 702 has not been registered yet so that it may be shown by the result of algorithm calculation of the level 2. Now, a mobile station is registered into the cell 710 in the point 2 of drawing 6. the registration to the cell 710 -- in addition, the mobile station 702 is automatically registered also into all the cells in the group 712, and generates the boundary for two cells around the registration cell 710 also here. The mobile station 702 can be moved anywhere in the buffer space for these two cells defined by the group 712, without re-registering.
[0042]If the mobile station 702 moves in accordance with the course 708 to the point 3 of drawing 6, a mobile station will come to the cell 714. The mobile station 702 is not registered into this cell. Therefore, at the point 3, the mobile station 702 is registered into the cell 714, and is registered into all the cells further located in the group 716. The cell in the group 716 is identified by vertical hatching. In accordance with the course 708, it moves further, and if the mobile station 702 reaches the cell 718 which has not been registered yet, a mobile station will be registered into the cell 718 and will be automatically registered into all the cells contained in the group 720.
[0043]As shown in drawing 7, once registration is performed, the big thing for which registration is again started for signal cover ******** again will be lost by a new cell grouping. For this reason, the influence of the automatic position registered signal intensity equalization algorithm which the mobile station 702 uses decreases. Location registration becomes random through the whole service area by the dynamic cell grouping by this invention. That is, registration relates to the motion before a user. The location registration peaks which happen by this when a cell group is fixed are reduced. Since the cell group by this invention changes dynamically, they are scattered all over the whole service area, without concentrating on the cell border where location registration was fixed.
[0044]The above shows that this invention provides the system and method of registering the mobile station in a wireless telephone communications system. A mobile station will be registered into all the cells which are in a registration group further, if a mobile station registers with a registration cell in order to reduce the location registration traffic in a system. A group may contain a registration cell and all the continuous cells at least, and may contain the cell around other layers further. The level of registration is changed dynamically and corresponds to the radio-channel traffic in a wireless telephone communications system.
[0045]Although the specific example of this invention was illustrated and described, it can correct, therefore an attached claim includes such all the change and corrections included in the pneuma and the range of this invention.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
Especially the feature of this invention that it seems that it is new is specified in an attached claim. In this invention, the following explanation and an attached drawing are referred to with the further purpose and advantage.
Therefore, you can understand best.
Within a drawing, the same reference number identifies the same element.
[Drawing 1]The ideal geographical layout of the radiotelephone system which can use this invention is generally shown.
[Drawing 2]The cell registration as a function of the user position specification of the conventional radiotelephone system is shown.
[Drawing 3]The cell registration as a function of the user position specification in the radiotelephone system by this invention is shown.
[Drawing 4]It is a flow chart showing the method by this invention.
[Drawing 5]It is a cell discrimination system for the hexagon-head cell pattern which can use this invention.
[Drawing 6]The level of the cell grouping for the hexagon-head cell pattern used with this invention is shown.
[Drawing 7]The location registration by the mobile station in the radiotelephone system of drawing 1 by this invention is shown.
[Description of Notations]
100 Radiotelephone system
102,104,106,108 Base station
110 Network controller
112 Public telephone switching network
118,120,122 Service area

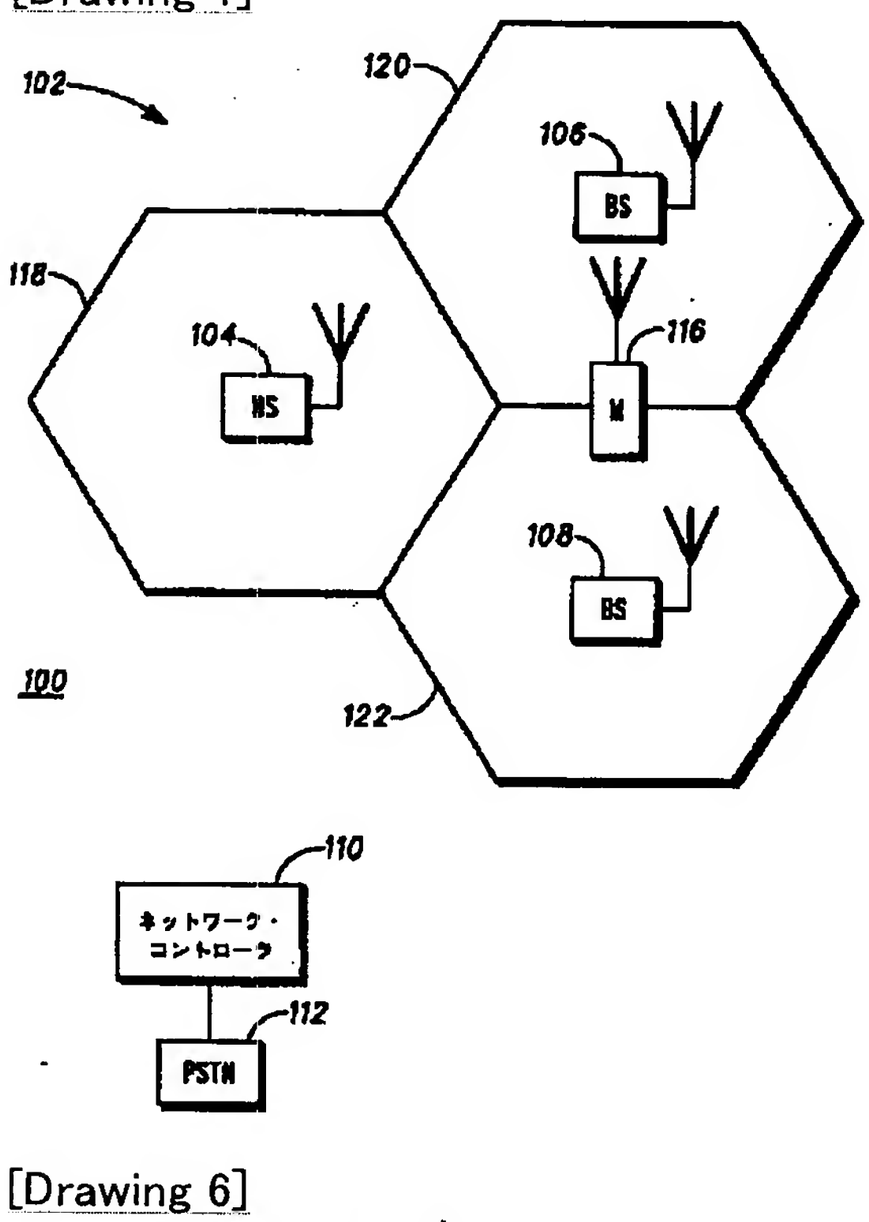
[Translation done.]

* NOTICES *

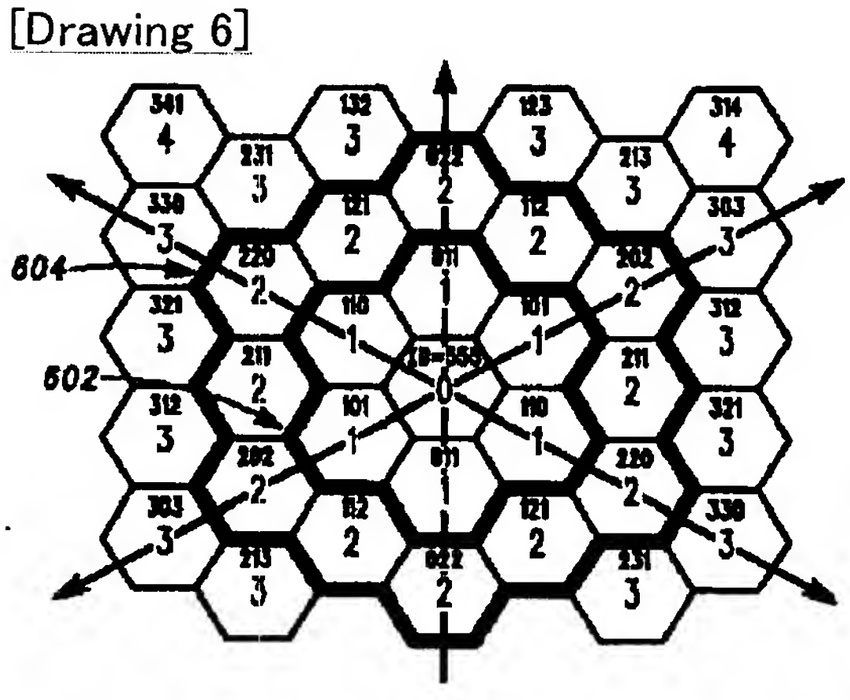
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

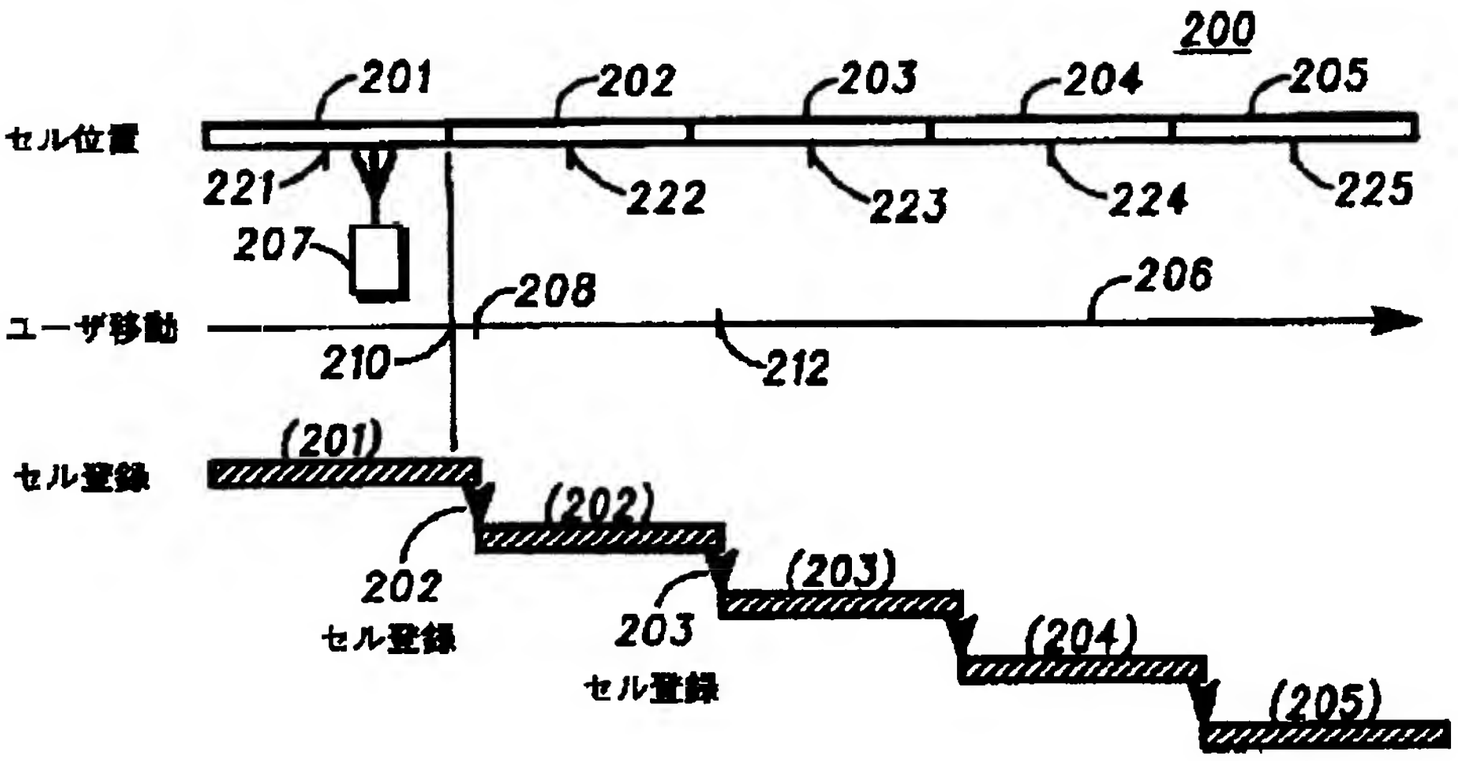
[Drawing 1]



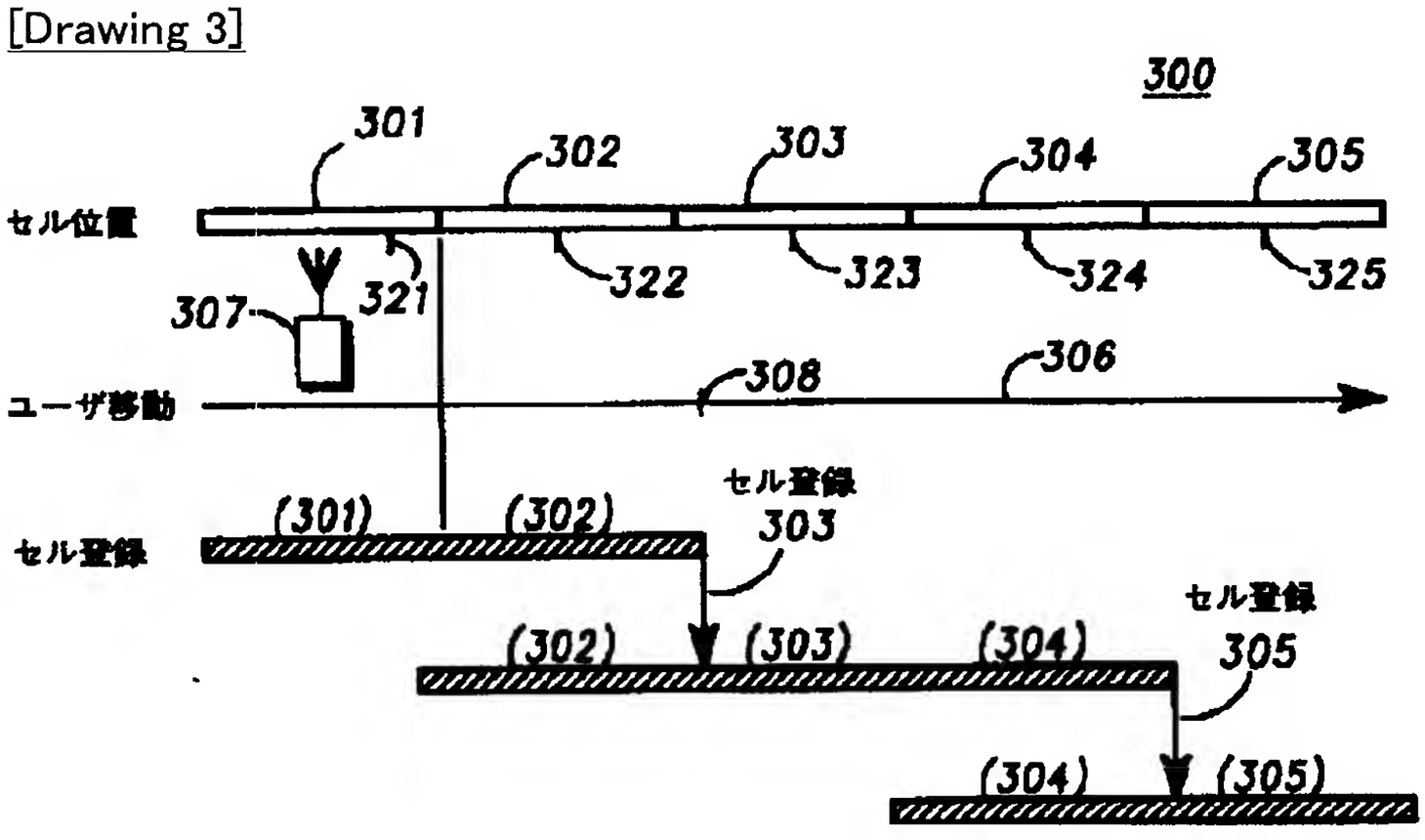
[Drawing 6]



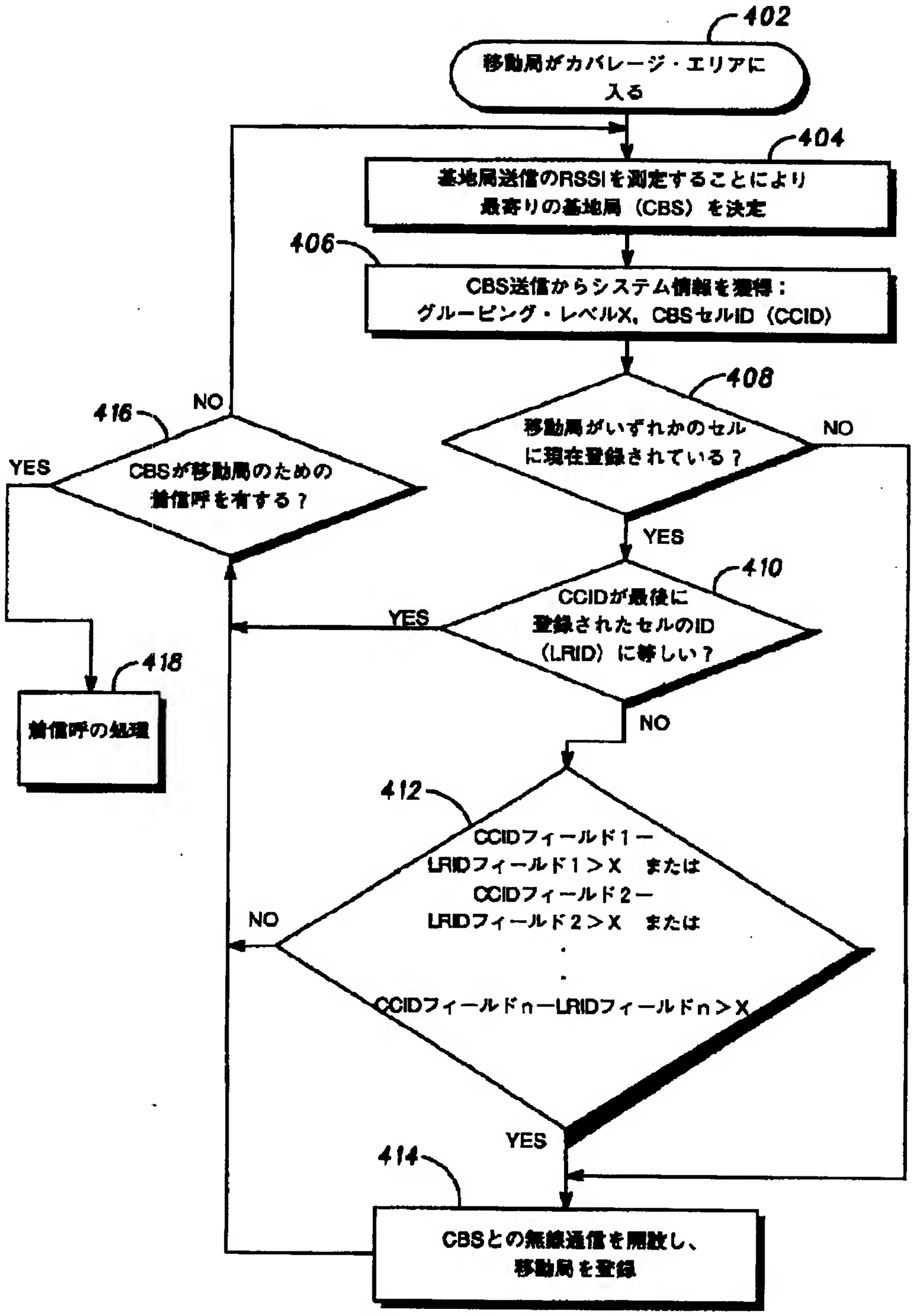
[Drawing 2]



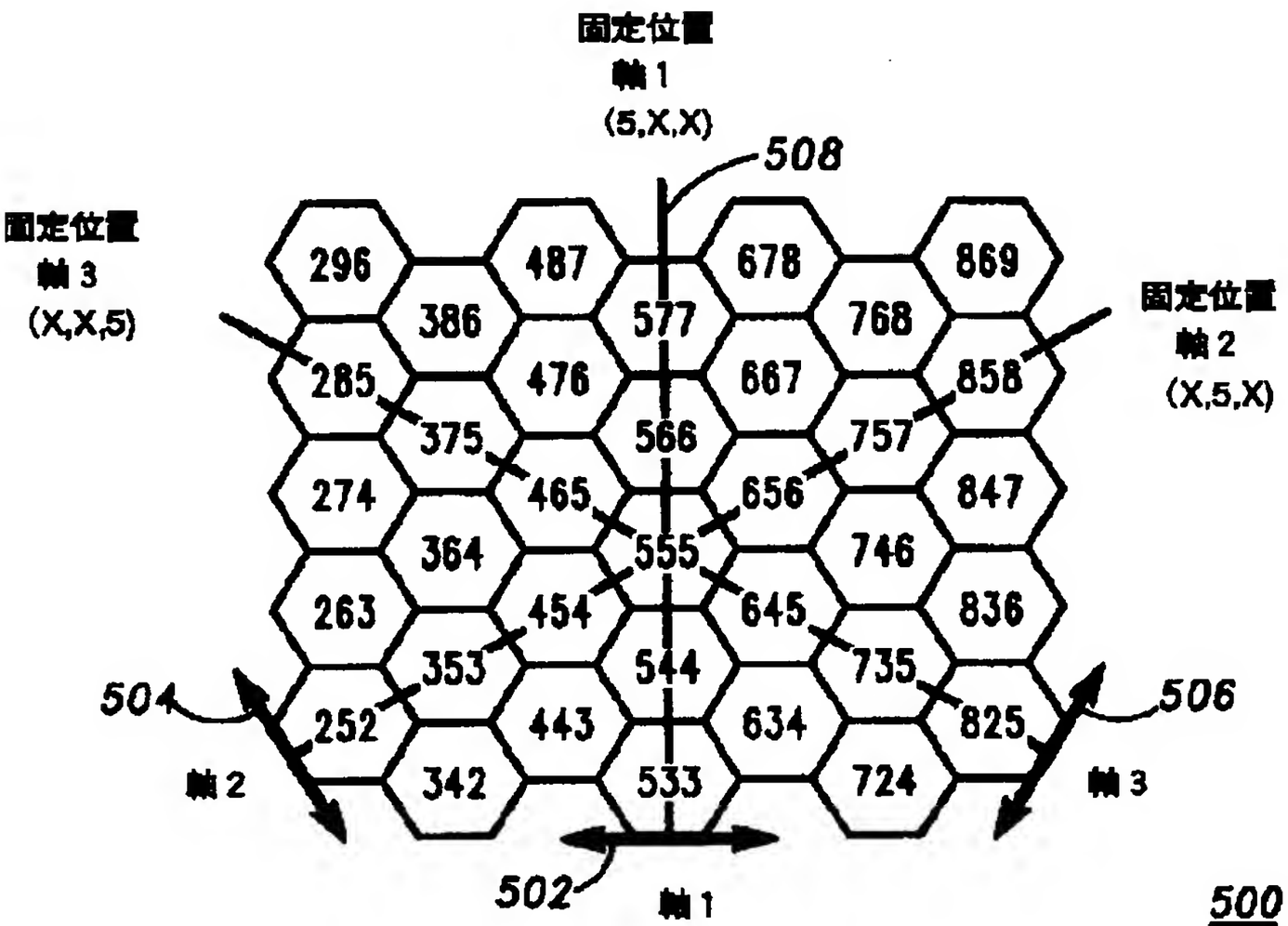
[Drawing 3]



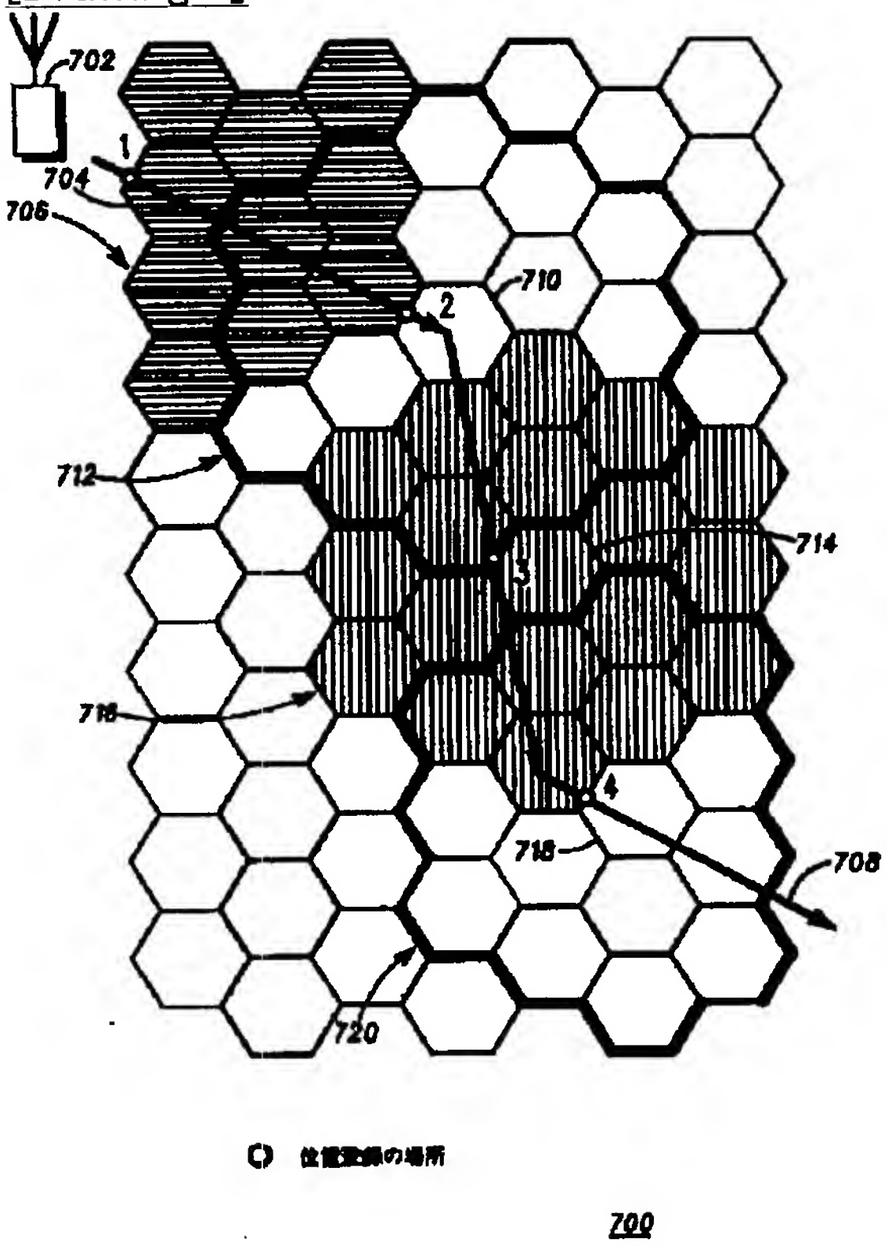
[Drawing 4]


402
移動局がカバレージ・エリアに入る
404
基地局送信のRSSIを測定することにより最寄りの基地局（CBS）を決定
406
CBS送信からシステム情報を獲得：グルーピング・レベルX，CBSセルID（CCID）
408
移動局がいずれかのセルに現在登録されている？
NO
YES
410
CCIDが最後に登録されたセルのID（LRID）に等しい？
YES
NO
412
CCIDフィールド1－LRIDフィールド1＞X　または
CCIDフィールド2－LRIDフィールド2＞X　または
CCIDフィールドn－LRIDフィールドn＞X
NO
YES
414
CBSとの無線通信を開設し、移動局を登録
416
CBSが移動局のための着信呼を有する？
NO
YES
418
着信呼の処理

[Drawing 5]



[Drawing 7]



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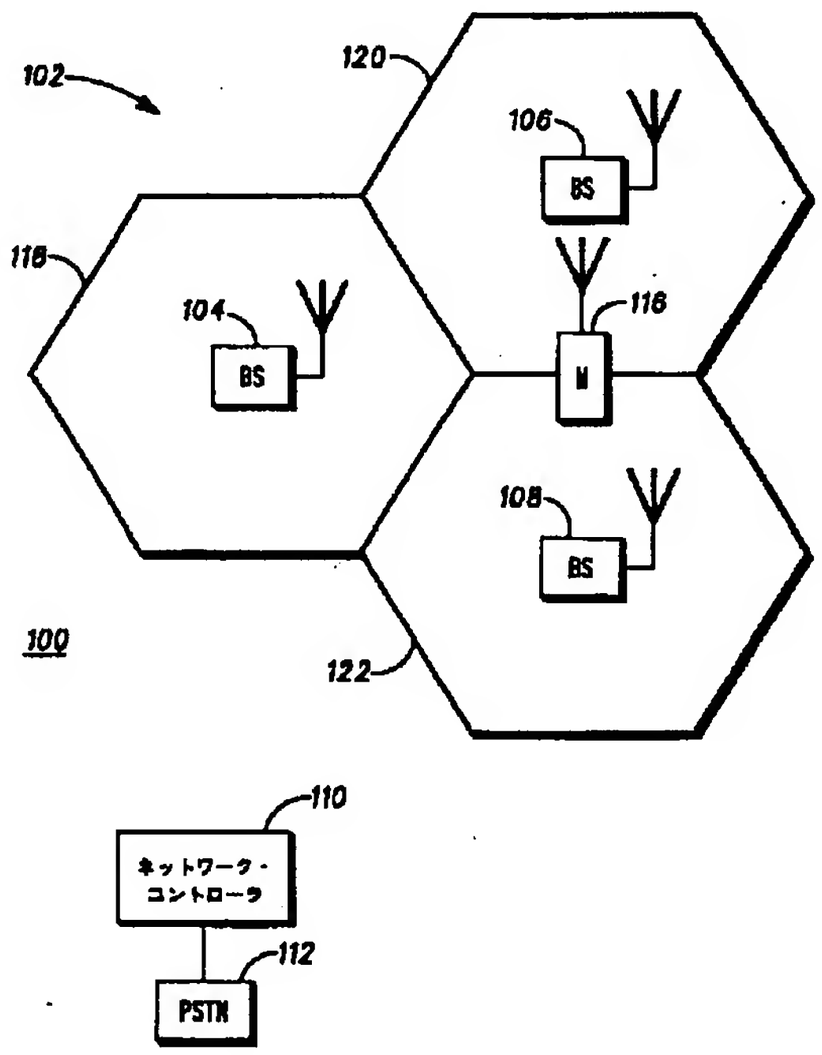
(54)【発明の名称】　無線電話システムのためのダイナミック・セル・グルーピングによる移動局位置登録の方法

(57)【要約】
【課題】　無線電話通信システム３００内で移動局３０７を登録する方法を提供する。
【解決手段】　移動局３０７は、基地局３２１からセル・グルーピング・レベルを含むシステム情報を受信する。移動局３０７は、基地局３２１に登録されているか否かを判断する。登録されていない場合は、移動局３０７が登録する。無線電話通信システム３００のネットワーク・コントローラは、自動的に移動局を、セル・グルーピング・レベルにより定義されたすべての基地局に登録する。移動局３０７は、同じアルゴリズムを用いて、それが自動的に登録された基地局の記録を維持する。



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【特許請求の範囲】

【請求項１】　ネットワーク・コントローラ（１１０）に結合された複数の基地局（３２１，３２２，３２３，３２４，３２５）を備え、移動局との無線通信を行うよう設定された無線電話システム（３００）内の移動局（３０７）を登録する方法であって：前記移動局を第１基地局に登録する段階；前記移動局において：第１基地局識別子を記憶する段階；前記第１基地局からの第１信号と、第２基地局からの第２信号とを受信する段階；前記第１信号および前記第２信号の被受信信号特性を検出する段階（４０４）；前記第１信号の被受信信号特性が受認不能で、前記第２信号の被受信信号特性が受認可能な場合に、前記第２基地局から、第２基地局識別子とセル・グルービング・レベルとを含む制御信号を受信する段階（４０６）；前記移動局が前記第２基地局に登録されている場合に、前記セル・グルービング・レベルから、前記第１基地局識別子と前記第２基地局識別子とを判定する段階（４１０）；前記移動局が前記第２基地局に登録されていない場合に、前記第２基地局を登録する段階（４１４）；および前記ネットワーク・コントローラにおいて：前記移動局の前記第２基地局への登録に応答して、前記移動局を前記セル・グルービング・レベルと前記第２基地局識別子とにより定義される基地局のグループに登録する段階；によって構成されることを特徴とする無線電話システム内の基地局を登録する方法。

【請求項２】　前記セル・グルービング・レベルと前記第１基地局識別子とが前記移動局が最後に登録した基地局の最終登録グループを定義し、前記判定段階が、前記最終登録グループに前記第２基地局が含まれるか否かを判定する段階（４１２）を含む請求項１記載の無線電話システム内の基地局を登録する方法。

【請求項３】　前記複数の基地局が１本以上の軸（５０２，５０４，５０６）上に配列され、前記第１基地局識別子と前記第２基地局識別子とが前記第１基地局と前記第２基地局との位置を１本以上の軸の各軸上でそれぞれ決定し、前記判定段階が、各軸上での前記第１基地局の位置と前記第２基地局の位置との差を前記セル・グルービング・レベルと比較する段階と、前記差が前記セル・グルービング・レベルを越える場合は前記移動局が前記第２基地局に登録されていないと結論づける段階（４１２）とによって構成される請求項１記載の無線電話システム内の基地局を登録する方法。

【請求項４】　前記第１基地局識別子と前記第２基地局識別子とがそれぞれ、１つ以上のフィールドを含み、前記の１つ以上のフィールドのそれぞれが前記１本以上の軸のうち１本の軸に対応し、１本以上の軸のうちのそれぞれの軸上に前記第１基地局および前記第２基地局の位置をそれぞれ一意的に決定し、前記比較段階が、前記第１移動局識別子の各フィールドを、前記第２基地局識別子の各フィールドから減じて１つ以上のそれぞれの結果

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を生成する段階と、各結果を前記セル・グルービング・レベルに比較する段階とによって構成され、前記結論づけの段階が、前記各結果のうち１つ以上の結果が前記セル・グルービング・レベルを越える場合に前記移動局が前記第２基地局に登録されていないと結論づける段階を含む請求項３記載の無線電話システム内の基地局を登録する方法。

【請求項５】　前記検出段階が、前記第１信号の第１被受信信号強度を測定する段階と、前記第２信号の第２被受信信号強度を測定する段階とを含み、前記方法が、前記第１被受信信号強度と前記第２被受信信号強度とに応答して最寄りの基地局を決定する段階（４０６）をさらに含む請求項１記載の無線電話システム内の基地局を登録する方法。

【請求項６】　前記移動局を前記第２基地局に登録する段階が、前記第２基地局との無線通信を開設する段階と、前記移動局からの登録要求を前記第２基地局に送信する段階（４１４）とによって構成される請求項１記載の無線電話システム内の基地局を登録する方法。

【請求項７】　前記複数の基地局が１本以上の軸上に配列され、前記第１基地局識別子および前記第２基地局識別子がそれぞれ１つ以上のフィールドを含み、前記１つ以上のフィールドの各フィールドが前記１本以上の軸のうち１本の軸に対応し、前記１本以上の軸のうち各軸上に前記第１基地局および前記第２基地局の位置をそれぞれ一意的に決定し、前記方法が：前記移動局において：前記第１基地局識別子の各フィールドを、前記第２基地局識別子の各フィールドから減じて１つ以上の結果を生成する段階；各結果を前記セル・グルービング・レベルに比較する段階；前記１つ以上の結果のうちいずれかの結果が前記セル・グルービング・レベルを越える場合に、前記移動局が前記第２基地局に登録されていないと結論づける段階（４１２）；前記第２基地局において：前記登録要求を受信する段階；および前記移動局を前記第２基地局に登録する段階（４１４）；によってさらに構成される請求項６記載の無線電話システム内の基地局を登録する方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、一般に無線電話システムに関する。本発明は、さらに詳しくは、コードレスまたはセルラ無線電話システム内の移動局の位置登録に関する。

【０００２】

【従来の技術および発明が解決しようとする課題】無線電話システムには、一般に、１つ以上の移動局と通信を行うよう設定された複数の基地局が含まれる。各基地局は、それぞれのサービス・エリア内で無線電話信号の送受信を行う。特定のサービス・エリア内の移動局は、そのエリアに連係される基地局と通信を行う。基地局は、

移動局と公衆電話交換網との間に通信を行う。無線電話システムは、ネットワーク・コントローラにより制御される。

【０００３】移動局は、複数のサービス・エリア内を移動する。移動局は、自動車に搭載されることも、ユーザが手持ちで運ぶこともある。移動局は、移動局と周辺の基地局との間の通信チャネルの状況、たとえば被受信信号強度（RSS: received signal strength ）などを監視する。移動局が第１のサービス・エリアから第２のサービス・エリアに移動すると、第２サービス・エリアにサービスを提供する基地局との通信を開設して、第１サービス・エリアにサービスを提供する基地局との通信を中止する。このプロセスをハンドオフと呼び、自動的に実行されるのが普通である。

【０００４】呼を特定の移動局に効率的に配するためには、各移動局がその位置を最も近い基地局に登録するのが普通である。それにより、着信呼はネットワーク・コントローラによりその基地局に対して送られ、その基地局は、移動局との無線通信を開設して呼を完了する。移動局が登録されないと、無線電話システムは、通常ページと呼ばれる同報メッセージを送って、移動局にその位置を登録するよう警告する。移動局が新しいサービス・エリアに移動すると、新しいサービス・エリアに連係する基地局に自動的に登録する。この登録プロセスは、ハンドオフとは独立して行われる。

【０００５】呼のトラフィック，ページング，登録およびその他の目的のために使用することのできる無線チャネル数は、各基地局毎に限られている。人口密度の高い地域では、システム使用度の高い時間帯には、使用可能な無線チャネルがないことがある。追加のチャネルを設けるための解決策の１つとして、より小さなサービス・エリアにサービスを提供する、より多くの基地局を設ける方法がある。密に位置する移動局を数多く有する都市地域などの極端な場合、通信を行い、チャネル・トラフィックを制御するために充分な数のチャネルを提供するためには、サービス・エリアは１ブロックまたは高層ビルの１階分ほど小さくなることもある。このようなサービス・エリアをマイクロセルと呼ぶ。

【０００６】追加の通信と制御チャネルを提供するためのマイクロセル法の限界は、サービス・エリア間を移動する多くの移動局の登録に必要とされるチャネル・トラフィックである。システム内の基地局とセルの数が増えるにつれて、ユーザ登録の数も必然的に増える。街中で携帯される各移動局は、それぞれ新しく入るサービス・エリアにサービスを提供する基地局に登録しなければならない。

【０００７】別の登録トラフィックの原因は、信号遮蔽である。移動局と基地局との間の経路内の物体により部分的に信号が阻止されると、遮蔽が起こる。遮蔽により、被受信信号強度を含む被受信信号品質に、極端で急

激な変化が起こることがある。たとえば、移動局がセル間の境界近くにある場合は、移動局が登録する適切な基地局の決定が信号遮蔽のために、短い時間の間に頻繁に変わることがある。移動局は、被受信信号強度が最大の基地局に登録しようとする。RSS レベルは、ユーザが振り返って、移動局のアンテナを被受信信号から遮ると変わることもある。このような場合、移動局は２つ以上の隣接する基地局に対して登録と再登録を繰り返し、登録トラフィックを増大させることになる。

【０００８】多数の加入者を扱うマイクロセル・システム内の位置登録に関して提案される解決策の１つは、多層位置更新方法である。この方法を用いるシステムのカバレージ・エリアは、複数の位置登録エリア層を有する。互い違いに配列され、互いに重なる一定数の層がある。移動局はグループに分けられ、各グループには１つ以上の層が割り当てられる。各グループの移動局は、いくつかの位置登録エリア層を有する。移動局がその登録を更新すると、移動局は層を切り換える、すなわち異なる層へ更新する。

【０００９】しかし、この方法は、実現が非常に複雑で、非効率的である。セルが１９セルのグループに分けられる六角セル構造を用いるシステムにおいては、この方法を実行するには１９層が必要である。層の数が多くなると、円滑に動作するためにはかなりの調整とシステム・オーバーヘッドが必要になる。各セル内の各基地局が、移動局がいつ再登録すべきかを決めることができるように層情報を送信しなければならないので、かなりの同報オーバーヘッドが必要になる。位置登録エリアをより多くの層に分割するには、同一の情報を層毎に、セル毎に送らねばならないために、より多くの同報情報が必要になる。

【００１０】従って、特にマイクロセルラ用途において、無線チャネルの登録トラフィックを削減する、無線電話システム内の移動局の改善された登録方法が必要である。

【００１１】

【実施例】図１は、本発明を用いることのできる無線電話システム１００の理想的な地理的レイアウトを一般的に示す。無線電話システム１００は、一般に基地局１０４，基地局１０６および基地局１０８を含む複数の基地局１０２と、ネットワーク・コントローラ１１０とを備える。ネットワーク・コントローラ１１０は、公衆電話交換網１１２に結合される。ネットワーク・コントローラ１１０は、さらに、複数の基地局１０２の各基地局と有線通信状態にある。ネットワーク・コントローラ１１０と複数の基地局１０２との間の個々の接続は、図面を過度に複雑にしないための図１には図示されない。

【００１２】複数の基地局１０２のそれぞれは、移動局１１６などの１つ以上の移動局と無線通信を行うよう設定される。この無線通信は、当技術では周知の標準化プ

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ロトコルに従って行われる。ここで用いられる「移動局」または「移動」という言葉は、自動車その他の乗り物や、内蔵型でユーザが持ち運ぶことのできる携帯無線電話ハンドセットに搭載される移動無線電話を指す。１つ以上の基地局１０４，１０６，１０８との無線通信を通じて、移動局１１６は、システム１００内の他の移動局（図示せず）または公衆電話交換網１１２に結合された他の加入者との呼を完了する。

【００１３】有効な無線電話通信を行うために、複数の基地局１０２の各基地局が、それぞれのサービス・エリアにサービスを提供する。これにより、基地局１０４はサービス・エリア１１８に、基地局１０６はサービス・エリア１２０に、基地局１０８はサービス・エリア１２２にサービスを提供する。図１において、サービス・エリアは六角形に図示される。しかし、サービス・エリア１１８，１２０，１２２は、三角形，四角形その他の任意の図形を有してもよいことが当業者には認識頂けよう。さらに、システム１００は、任意の数の基地局と、システム１００と関連して動作する移動局１１６などの任意の数の移動局とを備えることができることを当業者には認識頂けよう。

【００１４】次に、図２を参照して、ここには従来技術による無線電話システム２００内のユーザ位置特定の機能としてのセル登録を示す。簡単にするために、図２は、１つの軸２０６に沿ったユーザの移動を示す。そのため図２は、一連のサービス・エリアを通る全体にまっすぐな経路に沿って移動局を運ぶ、たとえば、街路，高速道路またはその他の道路に沿って移動したり、列車に乗って旅行中の、あるいは高層ビル内のエレベータに乗っているユーザの場合のセル登録をモデル化する。

【００１５】従来技術による無線電話システム２００は、図２に示されるように、セル２０１，２０２，２３０，２０４，２０５を備える。セル２０１，２０２，２０３，２０４，２０５は、軸２０６に沿って直線的に配置される。セル２０１，２０２，２０３，２０４，２０５のそれぞれは、それぞれのセル２０１，２０２，２０３，２０４，２０５内に位置する１つ以上の移動局と無線通信を行う基地局を備える。セル２０１は、基地局２２１を備える。セル２０２は、基地局２２２を備える。セル２０３は、基地局２２３を備える。セル２０４は、基地局２２４を備える。セル２０５は、基地局２２５を備える。

【００１６】図２は、さらに、移動局を運ぶユーザが軸２０６に沿って移動した場合にセル登録が行われる位置を示す。これは、図２の下半分に示され、括弧内の数は、移動局２０７が軸２０６に沿って移動するにつれて移動局２０７が登録されるセルを表す。これにより、図２の左側から、移動局はセル２０１に登録する。すなわち、移動局２０７は、セル２０１により定義されるサービス・エリアにサービスを提供する基地局２２１に登録

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する。移動局が軸２０６に沿って動くと、移動局２０７はセル２０１内に位置する基地局２２１およびセル２０２内に位置する基地局２２２を含む基地局から受信された信号の品質を監視する。基地局２２２から受信された信号の信号品質、被受信信号強度（RSS）などが軸２０６上の指定点２０８で、基地局２２１から受信された信号の品質を越えると、ハンドセットはセル２０２内の基地局２２２に登録して、セル２０１内の基地局２２１との登録を停止する。種々の被受信信号の品質と、移動局２０７が用いる信号強度平均化アルゴリズムのヒステリシスとによっては、セル２０２との登録が行われる点、すなわち点２０８には、セル２０１とセル２０２との地理的な境界線を規定する点２１０をハンドセットが横切った後で到達することもある。移動局２０７は、軸２０６に沿って移動を続け、被受信信号品質の監視を続ける。移動局が点２１２に到達すると、移動局はセル２０３内の基地局２２３に登録する。

【００１７】これにより、移動局２０７を携帯するユーザが無線電話システム２００のサービス・エリアに入ると、移動局２０７は、まずセル２０１に登録して、システム２００のネットワーク・コントローラ（図示せず）がその移動局２０７の呼をセル２０１に送ることができるようにする。移動局２０７がセル２０２に移動すると、第２登録が自動的に行われて、ネットワーク・コントローラを新しく入ったサービス・エリアに更新する。移動局２０７は、それぞれのセルから受信した信号強度と品質とに基づいて、登録プロセスを開始する。中間点、点２１０における信号の変動によるセル間の多重登録を避けるために、移動局２０７は、ヒステリシス付の平均化アルゴリズムを実行する。これにより、通常は、移動局２０７が点２０８で隣接セル内に充分に入るまで、隣接セルに対する登録が遅延される。平均化アルゴリズムを用いても、セル間の中間点における多重登録は、物体遮蔽や他の小さなセクタの遮蔽効果により依然として起こる。このような多重登録のためにネットワーク・トラフィックが増加し、使用可能な容量が減少して、移動局２０７のバッテリ寿命が短くなる。

【００１８】次に図３を参照して、ここには、本発明による無線電話通信システム３００内のユーザ位置特定の機能としてのセル登録を示す。システム３００は、複数のセルまたはサービス・エリア３０１，３０２，３０３，３０４，３０５に分割される。図２と同様に、図３は移動局３０７を携帯するユーザが１つの軸３０６に沿って移動する一次元システム３００を示す。これにより、図３は、ユーザが、道路，鉄道またはエレベータ内など全体にまっすぐな経路に沿って移動局を持ち運ぶ場合のセル登録をモデル化する。

【００１９】システム３００は、複数のサービス・エリアのそれぞれのサービス・エリア３０１，３０２，３０３，３０４，３０５にそれぞれがサービスを提供する複

数の基地局を備える。サービス・エリア３０１は、基地局３２１を備える。サービス・エリア３０２は、基地局３２２を備える。サービス・エリア３０３は、基地局３２３を備える。サービス・エリア３０４は、基地局３２４を備える。サービス・エリア３０５は、基地局３２５を備える。各サービス・エリア３０１，３０２，３０３，３０４，３０５にサービスを提供する基地局は、各サービス・エリア３０１，３０２，３０３，３０４，３０５内に位置する移動局３０７などの移動局と無線通信を開設する。さらに、基地局は、制御チャネル上にシステム情報を送信して、これは移動局３０７などの移動局により受信される。基地局と移動局とは、所定の通信プロトコルに従って制御チャネルおよび通信チャネルを用いて通信を行う。

【００２０】図３は、移動局を携帯するユーザが軸３０６に沿って移動するときにセル登録が発生する位置をさらに示す。図３においては、セル・グルーピング・レベル１が想定される。これを図３の下半分に示し、括弧内の数字は移動局が軸３０６に沿って移動するときに移動局３０７が登録されるセルまたはサービス・エリアを示す。これにより、図３の左側から、移動局３０７はセル３０１に登録する。すなわち、移動局３０７は、セル３０１により定義されるサービス・エリアにサービスを提供する基地局３２１に登録する。さらに、本発明により、移動局３０７は、セル・グルーピング・レベル１により定義されるセルのグループ内のすべてのセルにも登録される。これで、移動局は図３に示されるように、セル３０２にも登録される。

【００２１】移動局３０７が軸３０６に沿って移動すると、移動局３０７は、セル３０１内に位置する基地局３２１，セル３０２内に位置する基地局３２２およびセル３０３内に位置する基地局３２３を含む基地局から受信された信号の品質を監視する。基地局３２３から受信された信号の品質、たとえば被受信信号強度（RSS:received signal strength）などが、基地局３２１および基地局３２２から受信された信号の品質を越えると、移動局３０７は点３０８においてセル３０３内の基地局３２３に登録する。種々の被受信信号の品質と、移動局３０７が用いる信号強度平均化アルゴリズムのヒステリシスとによっては、セル２０２との登録が行われる点３０８には、セル３０２とセル３０３との間の地理的境界線を定義する点を移動局３０７が横切った後で到達することもある。

【００２２】移動局３０７が基地局３２３に登録すると、本発明により、移動局は、セル・グルーピング・レベル１により定義されるセルのグループ内にあるすべての基地局にも登録される。すなわち、移動局は、セル３０４内の基地局３２４とセル３０２内の基地局３２２にも登録される。この点で、移動局は、再登録の必要なしにセル３０２，３０３または３０４のいずれの中でも自

由に移動することができる。さらに、たとえばセル３０３とセル３０２の境界に近い、あるいはセル３０３とセル３０４の境界に近いセル３０３内での移動局３０７の移動は、２つの隣接する基地局との登録と再登録を繰り返すことなく行われる。それにより、無線電話システム３００内の登録トラフィックが削減される。

【００２３】移動局３０７は、軸３０６に沿って移動を続け、被受信信号品質の監視を続ける。セル３０５内の基地局３２５からの信号品質が、セル３０４内の基地局３２４からの信号品質を越えると、移動局３０７はセル３０５内の基地局３２５に登録する。本発明と、セル・グルーピング・レベル１により、移動局３０７はセル３０４内の基地局３２４にも登録するか、あるいはその登録を維持する。

【００２４】図３は、レベル１のセル・グルーピングを示し、これは閾値と、登録エリアに含まれる登録セルに隣接するセルの数を示す。レベル１のセル・グルーピングでは、移動局３０７は登録セルに連続するすべてのセルに登録する。しかし、アルゴリズムにより提供されるセル・グルーピングのレベルは変わることがある。たとえば、レベル２またはレベル３のセル・グルーピングも可能である。好ましくは、このレベルはセル毎にプログラミング可能であり、登録プロセスの間に移動局３０７にダウンロードされる。これにより、変わりつつあるトラフィックとシステム３００に対するシステム需要とに応じて、セル・グルーピングをダイナミックに調整することができる。

【００２５】図４は、本発明による無線電話システム内の移動局を登録する方法を示す流れ図である。この方法は、ステップ４０２で始まり、ここで移動局３０７（図３）などの移動局が、無線電話システム３００（図３）などの無線電話システムのカバレージ・エリアに入る。ステップ４０４で、移動局は、第１サービス・エリアにサービスを提供する第１基地局から第１信号を受信する。さらに、移動局は、第２基地局から第２信号も受信し、その他の信号も同様に受信する。好ましくは、第１信号および第２信号は、第１および第２基地局により同報される制御チャネル信号によって構成される。制御チャネル信号は、無線電話システム内の第１基地局および第２基地局を一意的に識別する基地局識別子などのシステム情報を含む。本発明により、システム情報は、第１サービス・エリアを含む１つ以上のサービス・エリアのグループを定義するセル・グルーピング・レベルをも含む。以下に詳細に説明されるように、セル・グルーピング・レベルは、無線電話システムにより移動局が自動的に登録される第１サービス・エリアを囲むサービス・エリアの階層すなわちセルの数を定義する。

【００２６】また、ステップ４０４で、移動局は、第１信号，第２信号およびその他の被受信信号の被受信信号特性を検出する。好ましくは、信号特性は、被受信信号

強度指標（RSSI：received signal strength indication）などの被受信信号の品質に関わる。被受信信号強度指標を検出する回路は、当技術では周知のものである。被受信信号特性に応答して、移動局は、移動局が最良の信号品質を有する信号を受信する基地局を、第１基地局として選択する。たとえば、移動局は、どの基地局が、最寄りの基地局に対応する最大の被受信信号強度を有するかを判断する。

【００２７】ステップ４０６で、移動局は第１基地局により同報された第１信号を受信する。移動局は、第１信号からシステム情報を決定する。システム情報には、好ましくは、セル・グルーピング・レベルと、基地局を一意的に識別する第１セル識別子または基地局識別子とが含まれる。

【００２８】好ましくは、サービス・エリアなどの無線電話システム内のサービス・エリアは、１つ以上の軸に沿って配列される。多次元システムにおいては、サービス・エリアは複数の軸に沿って配列される。本発明により、基地局識別子（またはセル識別子）は、１つ以上の軸の各軸上で、一意的に基地局（と関連するサービス・エリアと）の場所を決定する。基地局識別子には、好ましくは、１つ以上の軸のうち１つの軸に対応する１つ以上のフィールドが含まれる。基地局識別子を用いて、セルまたはサービス・エリアを、特定のサービス・エリアを囲むサービス・エリアの階層内にあると見なすことができる。

【００２９】本方法の説明を続けるが、ステップ４０８で、移動局は、その移動局が現在無線電話システムのいずれかのセルに登録されているか否かを判断する。好ましくは、移動局は、それがある場合に、移動局が登録していた最終セルの基地局識別子を示す最終登録セル識別子を含む、先行セル登録の指標を記憶するメモリを備える。移動局がシステムのカバレージ・エリアに入ったばかりの場合、あるいは起動されたばかりのときは、移動局はまだ登録されておらず、実行はステップ４１４に続く。移動局が以前登録されたことがある場合は、最終登録セル識別子を含む登録情報が移動局により読み取られて、実行はステップ４１０に続く。

【００３０】ステップ４１０で、移動局は、第１（最寄り）の基地局の基地局識別子が最終登録セル識別子と一致するか否かを判定する。この２つの識別子が一致すると、移動局は最寄りの基地局に以前登録されたことがあることになり、実行はステップ４１６に続く。２つの識別子が一致しない場合は、移動局は最寄りの基地局への登録が必要であるか否かを決定しなければならず、方法はステップ４１２に続く。

【００３１】ステップ４１２で、移動局は、ステップ４０４で判定された最寄りの基地局が最終登録されたサービス・エリアを囲むセル・グルーピング・レベルにより定義される１つ以上のサービス・エリアのグループに含まれるか否かを判定する。好ましくは、移動局は最寄りの基地局の基地局識別子と、最終登録セル識別子とに、以下のように関連する。

【００３２】移動局は、最寄りの基地局の基地局識別子と、最終登録基地局識別子とを比較する。最寄りの基地局の基地局識別子のそれぞれの軸フィールドのうち任意の１つと、最終登録基地局との差の絶対値がセル・グルーピング・レベルよりも大きい場合は、移動局は最寄りの基地局に登録する。この計算は、移動局が現在の登録セル・グループ内にあるのか、その外にあるのかを判定する基本的なアルゴリズムを表す。

【００３３】方法は、ステップ４１４に続き、そこで移動局が登録される。登録するために、移動局は無線電話システムの無線通信プロトコルに従って最寄りの基地局と無線通信を開設する。次に、移動局は最寄りの基地局に登録要求を送信し、基地局は、その基地局に移動局を登録して、登録情報をネットワーク・コントローラに送る。

【００３４】ネットワーク・コントローラの制御下で、移動局は第１基地局と、セル・グルーピング・レベルにより定義されるグループ内にあるすべての基地局とに登録される。これにより、１のセル・グルーピング・レベルでは、移動局は、第１基地局と連係するサービス・エリアと、すべての直接的に隣接するサービス・エリアとを含むサービス・エリアの階層内に登録される。セル・グルーピング・レベルが２の場合は、移動局は、セルのグルーピング・レベル１のグループに直接的に隣接するすべてのサービス・エリアにさらに登録される。セル・グルーピング・レベル１を用いるこの方法により、現在の最寄りの基地局によりサービスの提供を受けるセル（サービス・エリア）の周囲に１セル分のバッファができる。これにより、信号の変動またはセル間の遮蔽による多重登録がなくなる。この方法は、さらに、移動局がサービス・エリアに登録されると、移動局は隣接のサービス・エリアにも登録されるので、システム内のセル登録を削減する。

【００３５】隣接セルへの登録は、好ましくは、ネットワーク・コントローラ（図示せず）により行われ、システムは登録トラフィックをさらになくすることができる。ネットワーク・コントローラは、移動局と同じアルゴリズムを用いてどのサービス・エリアが移動局を登録するかを決定する。システムのネットワーク・コントローラは、移動局のダイナミック登録アルゴリズムの知識を基にして、移動局に呼を配する。

【００３６】図５を参照して、本発明と共に用いる二次元の六角セル・パターンのためのセル識別システムが図示される。図５は、セル識別子とも呼ばれる位置パラメータの、六角セル・パターン５００内のセルへの割当を図示する。セルのそれぞれは、第１軸５０２，第２軸５０４および第３軸５０６を含む３本の軸に沿って配列さ

れる。各フィールドは、１つの軸と連係され、フィールド内の数字は軸上のセル位置を指定する。同じ軸フィールド番号を有する隣接セルは、個別の軸に沿って固定位置を有し、直線５０８および軸５０２により図示される軸に垂直な直線を形成する。多重軸を用いる同様の位置パラメータ割当を、三角形のセルまたは正方形のセルなど、異なる形のセルを用いるセル・パターンに関して行うことができる。また、同じ位置パラメータ割当法を、図５を含むページから延びる第４軸を用いることにより三次元セル・パターンに拡張することができる。このようなセル・パターンは、多層階のオフィスビル内に設置されるマイクロセルラ無線電話システム内に存在することがある。

【００３７】図６は、六角セル・パターンの異なるレベルのセル・グルーピングと本発明に用いる識別子５００とを示す。各セル内の大きな１桁の数字は、識別子５５５を有するセルからの最大の軸オフセットを表し、小さい３つの数字は個々の軸オフセットを表す。上述のアルゴリズム内の全体グループ・レベル計算により、セル５５５に登録された移動局は、新しいセルの軸フィールドの大きさが指定されたグループ・レベルを越えると、新しいセルに登録されるに過ぎない。このため、図６で、移動局が大きな数字がグループ・レベルを超えるセルに移動すると、登録が行われる。レベル１のセル・グルーピングに関しては、移動局が、図６の中央の５５５と識別されるセルに連係するサービス・エリアにサービスを提供する基地局に登録すると、その移動局は、ネットワーク・コントローラ（図示せず）により、グループ６０２内のすべてのセルにも自動的に登録される。そのため、移動局に対する着信呼通知は、グループ６０２内のすべてのセルに送られる。これは、グループ・レベルを超えない最終移動局セル登録からの軸オフセットを持つすべてのセルに対して、呼の通知を送るだけで、ネットワークにより実行される。レベル２のセル・グルーピングに関しては、移動局が５５５と識別されるセルに登録すると、その移動局はグループ６０４内にあるすべてのセルにも自動的に登録される。

【００３８】図６では、各サービス・エリアは、サービス・エリアの階層により囲まれること、またセル・グルーピング・レベルは特定のサービス・エリアを囲むサービス・エリアの階層数を表すことがわかる。たとえば、グループ６０２は、図６に示されるように、サービス・エリアすべてが大きな数字１により示されるので、識別可能なサービス・エリアの階層に対応する。第２階層のサービス・エリアは、図６内で大きな数字２により示されるサービス・エリアを含む。

【００３９】図７は、本発明による無線電話システム７００内の移動局７０２によるレベル２の位置登録を示す。図７に示される二次元システム７００においては、移動局７０２は、ページの平面に含まれる３本のセル軸

のいずれに沿っても、自由に移動することができる。図７は、レベル２のグルーピングを示す。

【００４０】移動局７０２がシステム７００のサービス・エリアに入ると、移動局７０２は図７の点１においてセル７０４に登録する。すなわち、移動局７０２は、セル７０４にサービスを提供する基地局（図示せず）に登録する。さらに、移動局７０２は、レベル２の登録のためのグループ７０６に含まれるすべてのセルに自動的に登録される。これらのセルは、わかりやすくするために図７では横の陰影線を入れて図示される。これで、移動局７０２は、現在登録されているセルの周囲に２セル分のバッファを有する。

【００４１】移動局７０２が経路７０８に沿って移動すると、移動局７０２は、レベル２のアルゴリズム計算の結果により示されるように、移動局７０２がまだ登録されていないセル７１０に来る。これで、移動局は図６の点２において、セル７１０に登録する。セル７１０への登録に加えて、移動局７０２は、グループ７１２内のすべてのセルにも自動的に登録されて、ここでも登録セル７１０の周りに２セル分の境界を生成する。移動局７０２は、グループ７１２により定義されるこの２セル分のバッファ領域内のどこでも、再登録せずに移動することができる。

【００４２】移動局７０２が図６の点３まで経路７０８に沿って移動すると、移動局はセル７１４に来る。移動局７０２はこのセルには登録されていない。従って、点３で、移動局７０２はセル７１４に登録し、さらにグループ７１６内に位置するすべてのセルに登録する。グループ７１６内のセルは、縦の陰影線で識別される。経路７０８に沿ってさらに移動して、移動局７０２がまだ登録していないセル７１８に到達すると、移動局はセル７１８に登録し、グループ７２０に含まれるすべてのセルに自動的に登録する。

【００４３】図７に示されるように、一度登録が行われると、新しいセル・グルーピングにより、大きなまたは小さな信号遮蔽のために再度登録が開始されることがなくなる。このため、移動局７０２が用いる自動位置登録信号強度平均化アルゴリズムの影響が少なくなる。また、本発明によるダイナミック・セル・グルーピングにより、サービス・エリア全体を通じて位置登録が無作為になる。すなわち、登録は、ユーザの以前の動きに関連する。これにより、セル・グループが固定された場合に起こる位置登録ピークが削減される。本発明によるセル・グループは、ダイナミックに可変するので、位置登録が固定されたセル境界に集中せずにサービス・エリア全体に散らばる。

【００４４】上記から、本発明は無線電話通信システム内の移動局を登録するシステムおよび方法を提供することがわかる。システム内の位置登録トラフィックを削減するために、移動局が登録セルに登録すると、移動局は

さらに登録グループ内にあるすべてのセルに登録する。グループは、少なくとも登録セルと連続するすべてのセルを含み、他の層の周囲のセルをさらに含むこともある。登録のレベルは、ダイナミックに可変して、無線電話通信システム内の無線チャネルトラフィックに対応する。

【００４５】本発明の特定の実施例が図示および説明されたが、修正が可能であり、従って、添付の請求項は、本発明の精神と範囲に入るこのようなすべての変更および修正を包含するものである。

【図面の簡単な説明】

新規であると思われる本発明の特徴は、添付の請求項に特に明記される。本発明は、その更なる目的および利点と共に、以下の説明と添付の図面とを参照することにより、最もよく理解頂けよう。図面内では、同様の参照番号は同一要素を識別する。

【図１】本発明を用いることのできる無線電話システムの理想的な地理的レイアウトを一般的に示す。　＊

＊【図２】従来の無線電話システムのユーザ位置特定の機能としてのセル登録を示す。

【図３】本発明による無線電話システム内のユーザ位置特定の機能としてのセル登録を示す。

【図４】本発明による方法を示す流れ図である。

【図５】本発明を用いることのできる六角セル・パターンのためのセル識別システムである。

【図６】本発明と共に用いる六角セル・パターンのためのセル・グルーピングのレベルを示す。

【図７】本発明による図１の無線電話システム内の移動局による位置登録を示す。

【符号の説明】

１００　無線電話システム

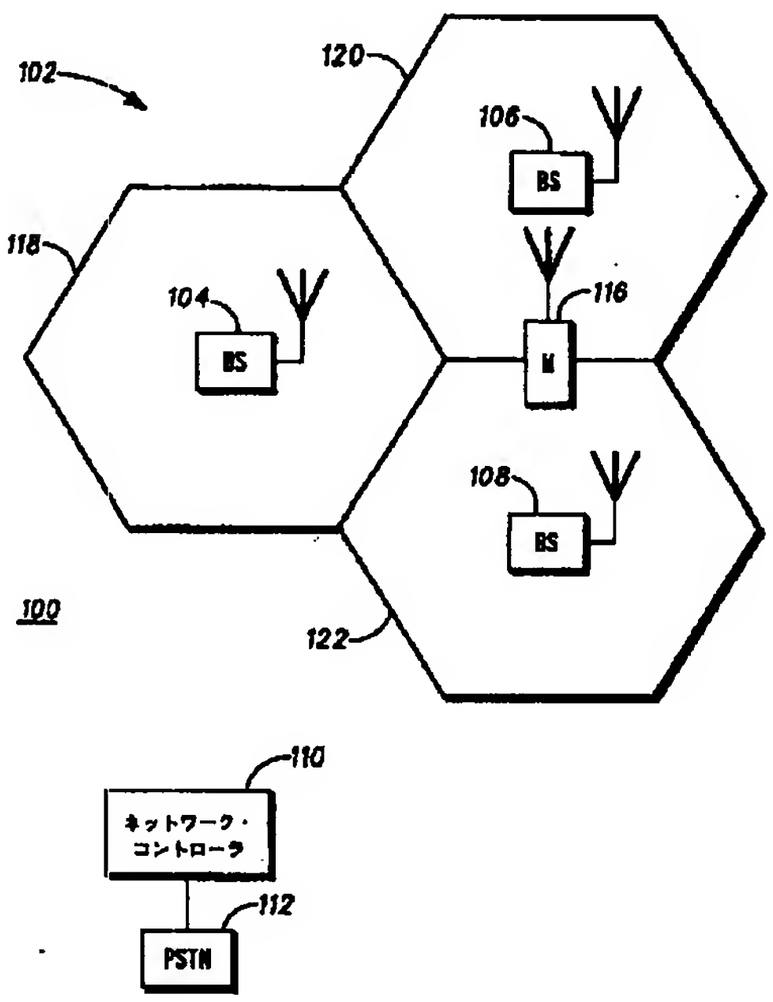
１０２，１０４，１０６，１０８　基地局

１１０　ネットワーク・コントローラ

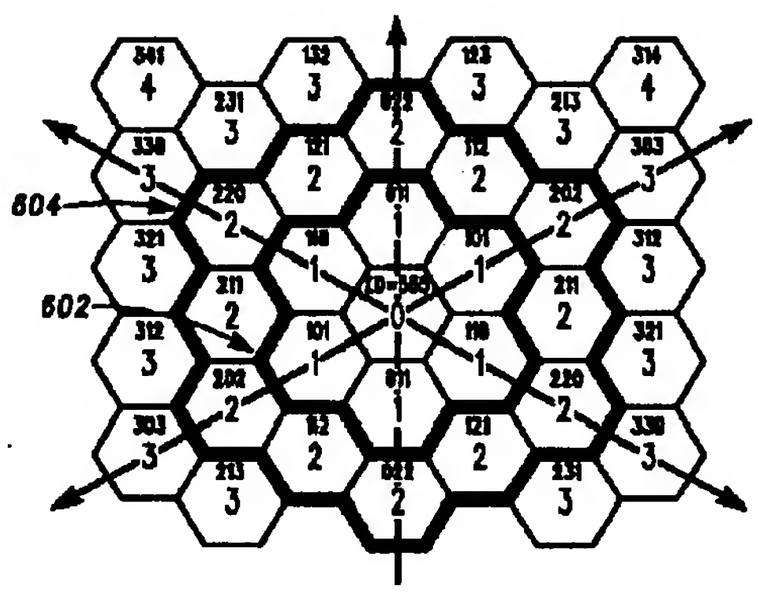
１１２　公衆電話交換網

１１８，１２０，１２２　サービス・エリア

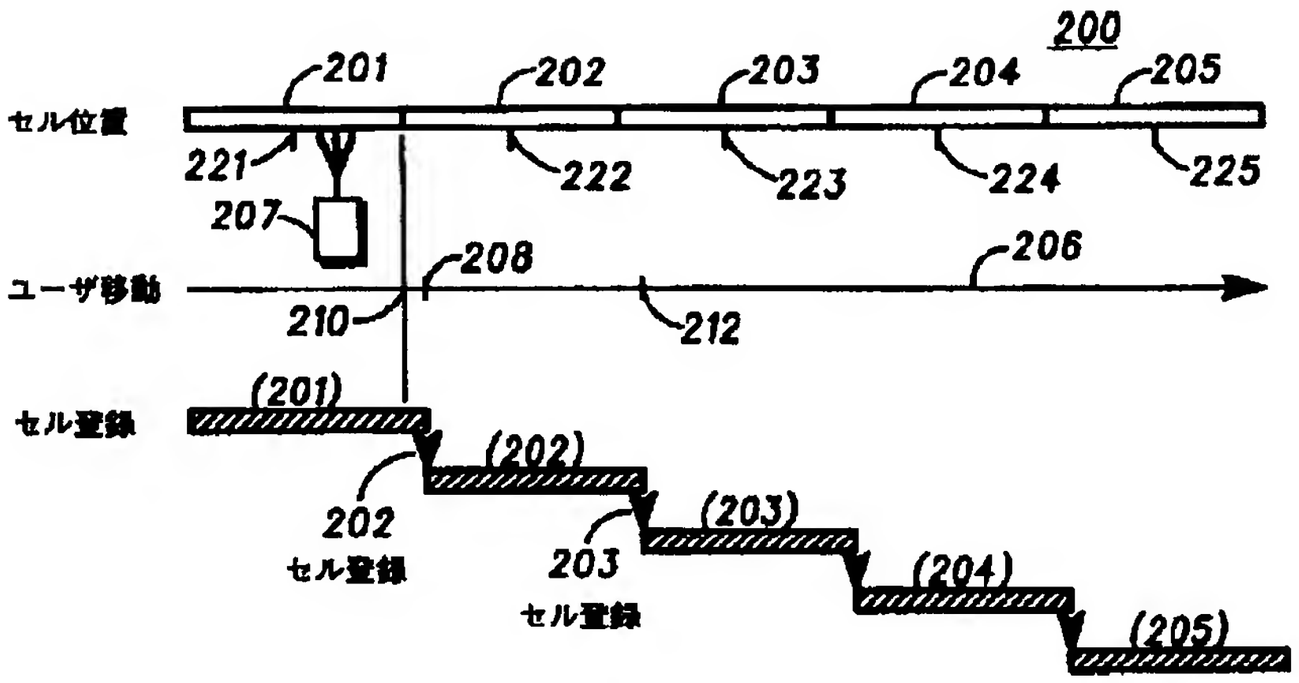
【図１】



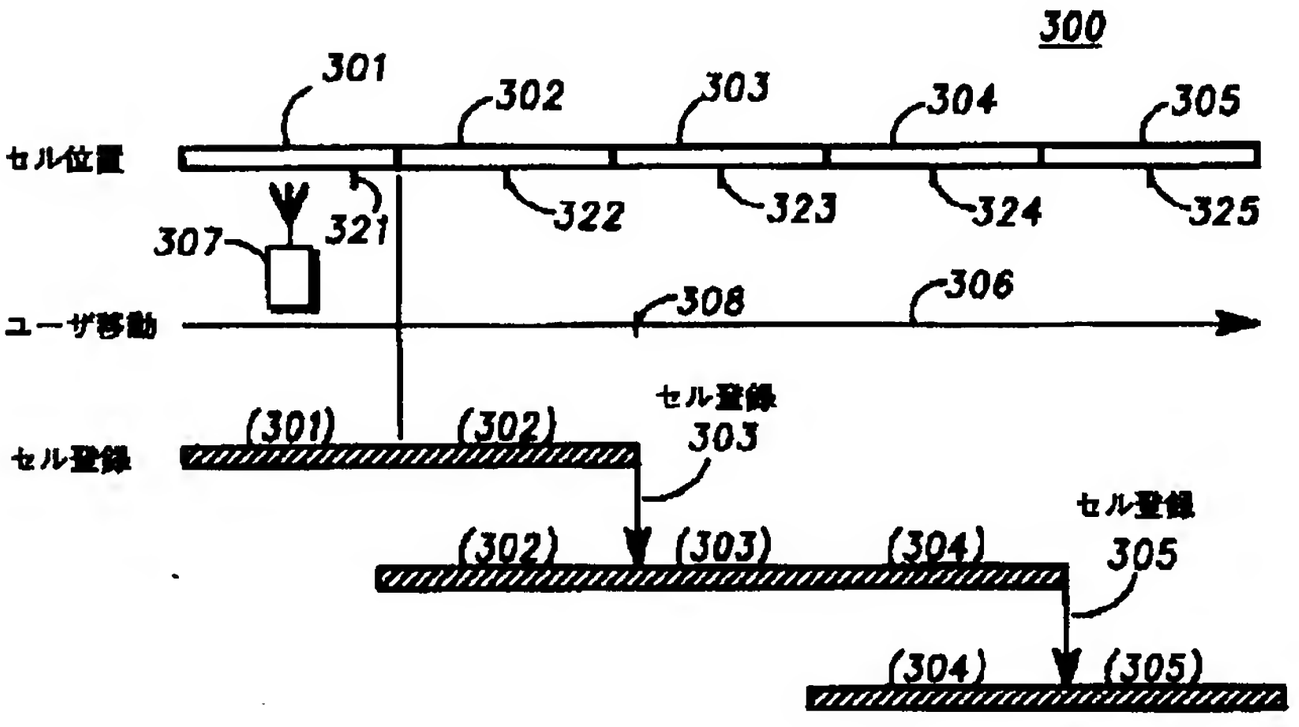
【図６】



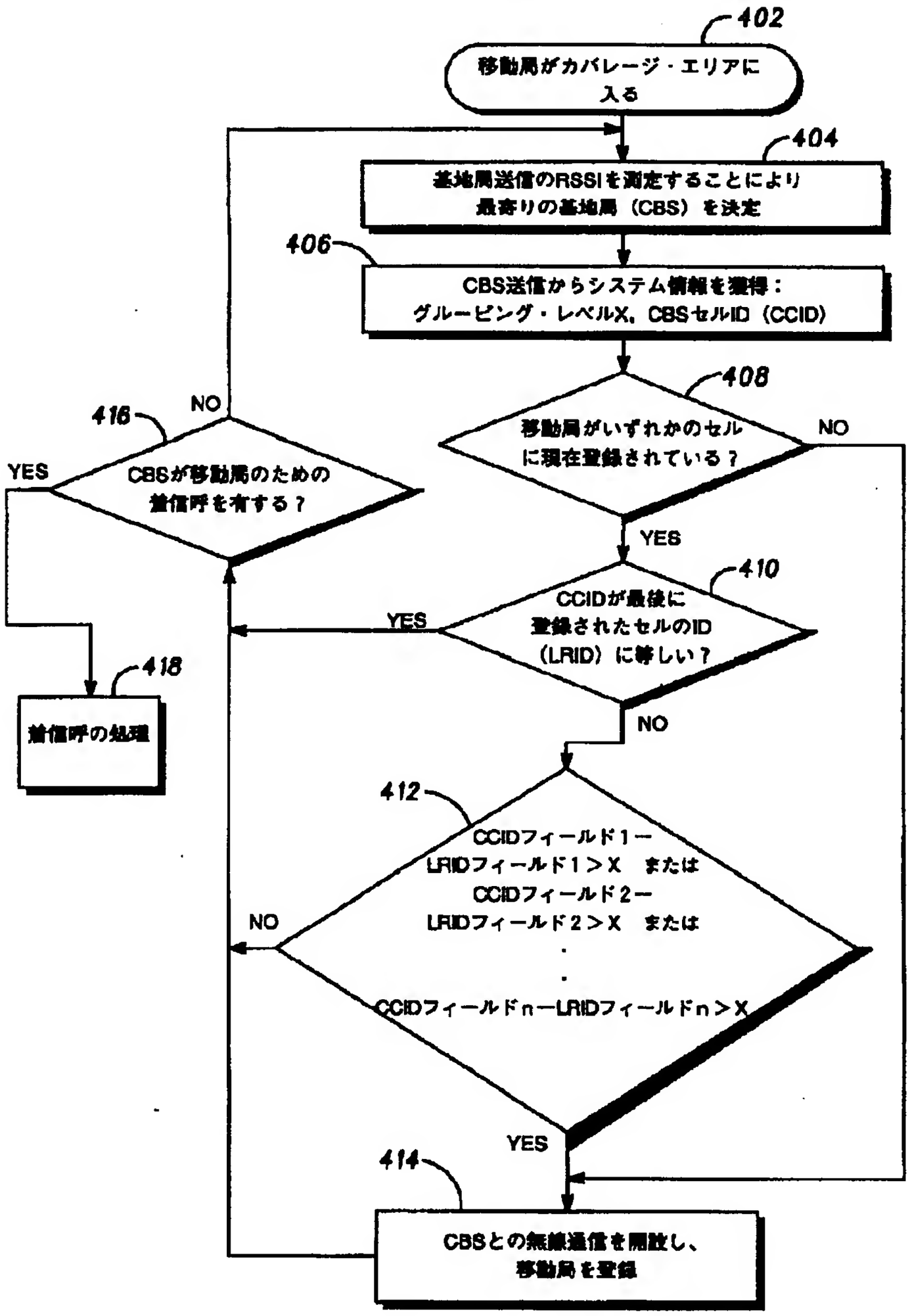
【図２】


200
201
202
203
204
205
セル位置
221
222
223
224
225
207
208
206
ユーザ移動
210
212
(201)
セル登録
(202)
202
セル登録
(203)
203
セル登録
(204)
(205)

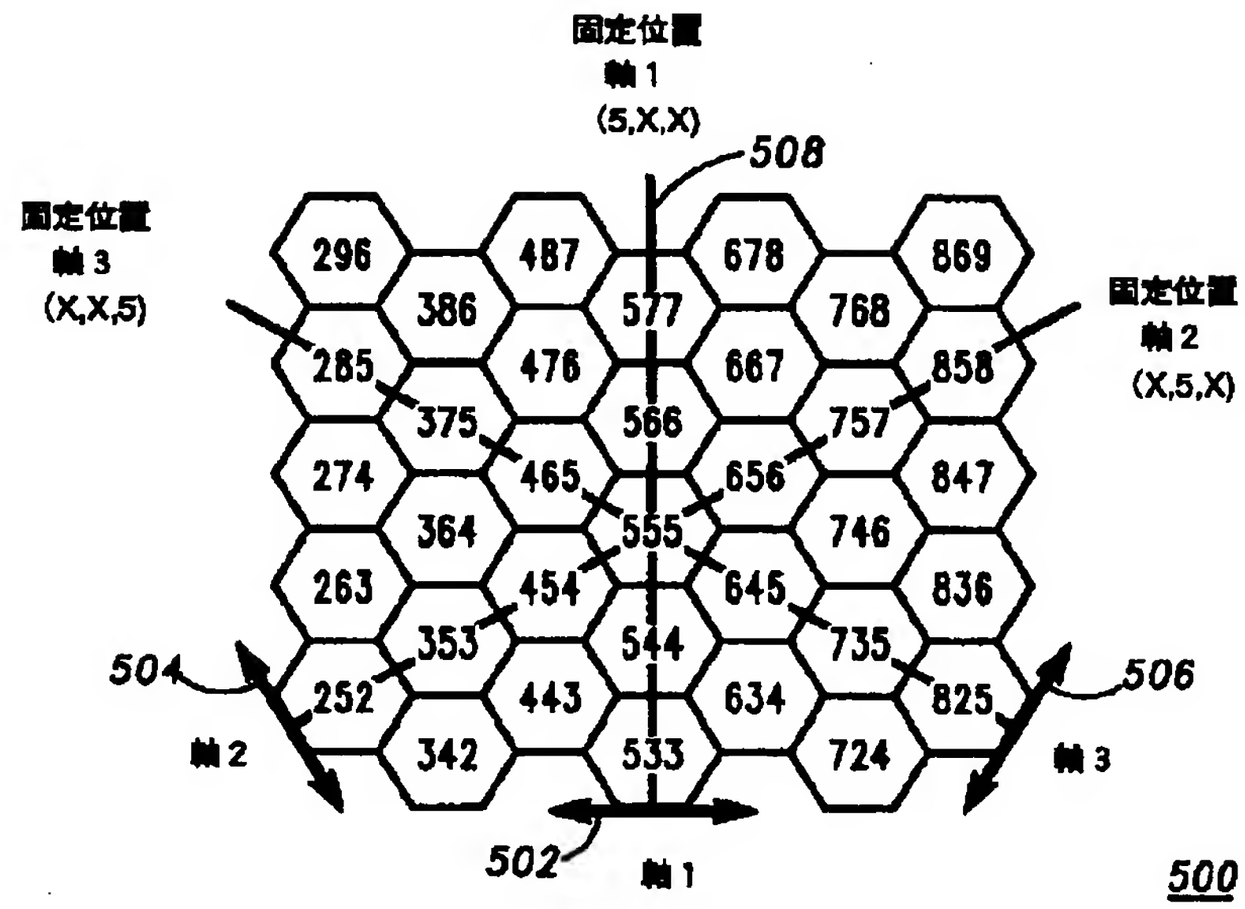
【図３】


300
301
302
303
304
305
セル位置
321
322
323
324
325
307
308
306
ユーザ移動
(301)
(302)
セル登録
303
セル登録
(302)
(303)
(304)
305
セル登録
(304)
(305)

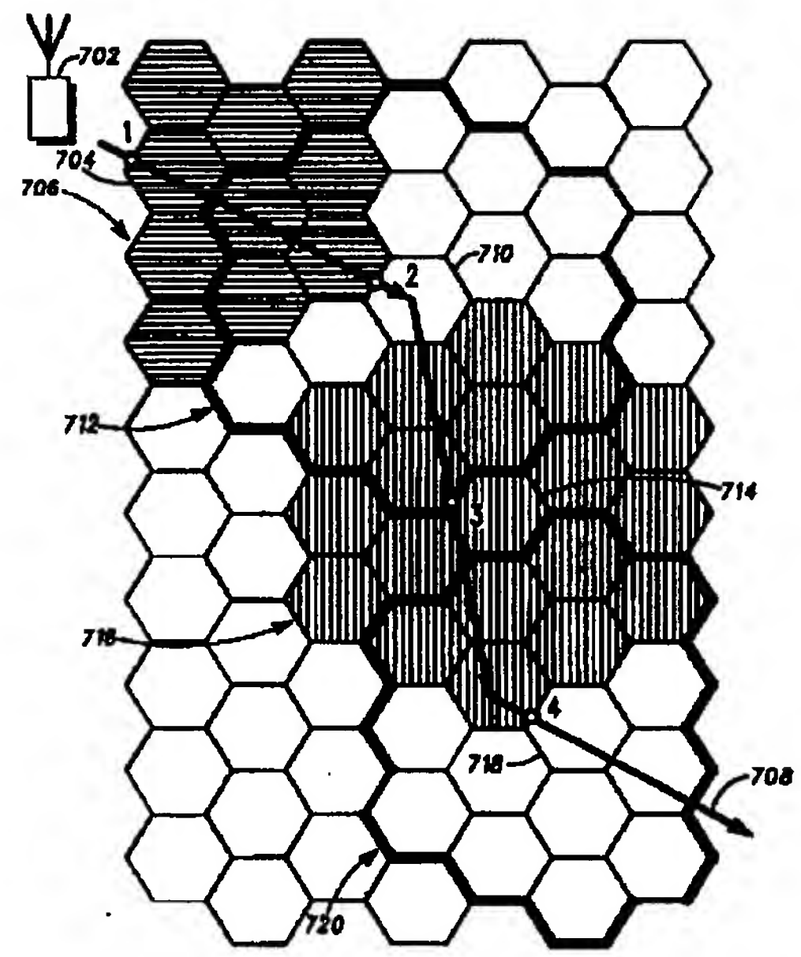
【図４】


402
移動局がカバレージ・エリアに入る
404
基地局送信のRSSIを測定することにより最寄りの基地局（CBS）を決定
406
CBS送信からシステム情報を獲得：グルーピング・レベルX，CBSセルID（CCID）
408
移動局がいずれかのセルに現在登録されている？
NO
YES
410
CCIDが最後に登録されたセルのID（LRID）に等しい？
YES
NO
412
CCIDフィールド1－LRIDフィールド1＞X　または
CCIDフィールド2－LRIDフィールド2＞X　または
・
・
CCIDフィールドn－LRIDフィールドn＞X
NO
YES
416
CBSが移動局のための着信呼を有する？
NO
YES
418
着信呼の処理
414
CBSとの無線通信を開設し、移動局を登録

【図５】


固定位置
軸１
(5,X,X)
508
固定位置
軸３
(X,X,5)
固定位置
軸２
(X,5,X)
296
487
678
869
386
577
768
285
476
667
858
375
566
757
274
465
656
847
364
555
746
263
454
645
836
353
544
735
504
252
443
634
825
506
342
533
724
軸２
軸３
502
軸１
500

【図７】


702
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